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[OFFICIAL NOTICE.]

TWENTY-FIFTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

GENERAL ANNOUNCEMENT.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
MONTCLAIR, N. J., Sept. 13, 1897.

There will be an annual meeting of the American Gas Light Asso ciation held in Old Point Comfort, Va., on October 20, 21 and 22, 1897

The meeting will be called to order by the President, Mr. Chas. H Nettleton, of Derby, Conn., at 9:30 o'clock A.M., Wednesday, October 20, in the meeting hall of the Hotel Chamberlin, the headquarters.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in so doing a reply should be requested, for which a self-addressed, stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The Chamberlin is conducted on the American plan, and the rates will be as follows: $3 per day for single room without bath; $4 for single room with bath; $3 for each person, in double room without bath; $4 for each person, in double room with bath.

The Hygeia Hotel, directly across the street from the Chamberlin, gives the same rates.

The meeting hall will be the dancing hall of the Hotel Chamberlin; thus the headquarters and the hall will be in the same building.

The Roll Call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of Application for Membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the Secretary's hands by Oct. 10, at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at this meeting is as follows:

"Some Further Experiments on Interior Illumination," by Mr. Alten S. Miller, Long Island City, N. Y.

"Chemical Notes on Purification," by Mr. Henry A. Mather, Brooklyn, N. Y.

"Gas Advertising," by Mr. R. M. Searle, Atlanta, Ga.

"A Report on Burner Stoppages," by Mr. Paul Doty, Long Branch, N. J.

A paper by Mr. K. M. Mitchell, St. Joseph, Mo., giving an account of a method successfully employed by him to obviate trouble from naphthaline.

A paper, the name of the author of which we are not yet at liberty to give.

In addition to the above there will be several topics brought in for discussion by short written introductions.

All questions for the Question Box should be sent in to the Secretary as soon as possible, in order that they may be printed in the next circular before the meeting, thereby insuring their discussion.

During the days of the meeting all announcements will be posted on the Bulletin Board in the meeting room. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the Year Book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given, that if any of the speakers at the meeting desire to correct their remarks in discussions before they are printed, they will be given an opportunity before leaving Old Point, but *not* after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the

meetings, and all those who desire to correct their remarks *must* notify the Secretary at the close of the session at which such remarks are made, as all the report will be turned in to the printer immediately after the adjournment of the meeting.

Special rates for transportation have been granted (viz., full fare going and one-third fare returning by the same route), by the several Passenger Associations named, and under the conditions noted.

The Trunk Line Passenger Committee, covering territory west of New England and east of Niagara Falls, Buffalo and Salamanca, N. Y.; Pittsburg, Pa.; Bellaire, Ohio; Wheeling, Parkersburg and Charleston, W. Va.

The New England Passenger Association, covering nearly all of the lines in the New England States.

The Southeastern Passenger Association, covering the territory south and west of the Virginias, and south and east of the Ohio and Mississippi Rivers.

The Central Passenger Committee, covering the following grounds: Bounded on the east, by Pittsburg, Salamanca, Buffalo and Toronto; on the north, by the line of and including points on the Grand Trunk Railway, from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook County, Illinois; on the west, by the west line of Cook County and the Illinois and Mississippi Rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio River, including points on either side of that river.

The Western Passenger Association, covering the territory west of and not including Chicago, Peoria and St. Louis—in other words, the territory west of that of the Central Association—have refused to grant the rate. Members from this territory should buy tickets from starting point to the nearest or most convenient point in the territory of any of the Associations granting the reduced rate, and at such point purchase tickets through to Old Point Comfort and obtain a certificate.

The following extracts from the regulations of the railroads are cited for the information of the members. The special rates are granted subject to these regulations.

First.—The reduction is conditional on there being an attendance at the meeting of not less than 100 persons holding certificates.

Second.—Each person, to obtain the excursion rate, must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

Third.—If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through tickets can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where each purchase is made.

Fourth.—Tickets for the return journey will be sold by the ticket agent at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

Fifth.—No reduction of fare will be made on the return passage, if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetings are held at distant points, to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

Sixth.—Certificates are not transferable, and return tickets secured upon certificates are not transferable. The transfer of any such is liable to prevent the securing of reduced rates for future meetings.

Seventh.—The certificate of agent at starting point, duly endorsed by Secretary of Association, must be presented to ticket agent at place of meeting, within three days (*Sunday* not reckoned, except by Southern Passenger Association), after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

Eighth.—No refund of fare will be made on account of any person failing to obtain a certificate.

The Old Dominion Steamship Company have also granted a round-trip fare of $10 from New York to Old Point. This includes stateroom and meals both ways.

SPECIAL.

Be sure to obtain a railroad certificate when buying your ticket for Old Point, as the greater the number of certificates handed in the easier it is to get the reduction in rates next year. Apply for ticket and certificate at least 30 minutes before train time. Each person must sign his own certificate at time of purchasing ticket for Old Point. Be sure to have the Secretary endorse your certificate at Old Point as soon as you get there. Apply for return ticket at least 30 minutes before train time, and have your certificate with you. Any person, ladies included, attending the meeting, is entitled to the reduced rate from the territories named. Members will please hand their certificates to the Secretary, or his clerk, upon arrival at place of meeting. If there are 100 members present, holding certificates, each certificate will then be properly endorsed and handed back to owner, before adjournment.

If a sufficient number of subscriptions are obtained there will be a banquet at the Hotel Chamberlin, Thursday evening, October 21, and an excursion on the waters of Hampton Roads and the James River, on Friday, October 22. Tickets admitting member to banquet and, with ladies accompanying him, to the excursion can be had for $5. If you wish to join in these entertainments please sign enclosed card and mail it to the Secretary at once. It will be necessary to have at least 100 subscriptions to make them successful.

ALFRED E. FORSTALL, Secretary.

Extracts from the Constitution.

SEC. 12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.

SEC. 51. No member who owes two years dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.

SEC. 52. Any member whose dues shall remain unpaid for a term of three years, may be dropped from the roll of membership by a vote of the Council.

BRIEFLY TOLD.

THE VIRGINIA MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.—The American Gas Light Association having seen fit to name Old Point Comfort, Va., as the place for holding the meeting that is to mark out the rounding of its quarter century of existence, all that remains for the faithful is to make the trip to that most famous of all Virginia's shores, on or before the days named by Secretary Forstall, in his matter-of-fact circular announcing the times of the convention. Speaking for the rank and file, we would have preferred that the meeting should have been held in this fairly representative American city, our preference being based on the fact that it was New York's turn to greet the Association; but if New York, by and through the fiat of the gas men who "named the place," was passed, it matters only now to us that Old Point is where we all shall be when the blaze of fall is on the woods, when the mist of autumn dims the noon, when the breath of Chesapeake Bay dulls the rugged outlines of the frowning old pile, from out the mouths of whose guns many speeches for freedom have been tellingly projected. So much for fancy; now for fact. Secretary Forstall's well put together circular shows that the Association made no mistake in naming him as the successor of the "Man from Providence," for he has learned that Mr. Slater's ways were based on study; and as study leads to safety, no matter much whether the study was or was not pursued in a set curriculum, Secretary Forstall has, quite like his father did, put aside eccentricity for method—which is bound to win. The paper programme that is given to the members abounds in merit, even though one number is anonymous; and the likelihood is that the mysterious one will about be the one to attract the most attention, for its composer is in no sense a mystery to the gas men of America. The paper card, as a whole, is noteworthy, for its numbers show that the young men are willing to tell what they know. Mr. Miller, of Long Island City, who is to have something to say about interior illumination, has long had charge of the greatest gas tunnel delivery line in the world, and right following on the list is the name of Mr. Henry A. Mather, whose purification material manufacturing plant is on Newtown Creek, just below where the mouth of the tunnel of Mr. Miller's Company gapes. Messrs. Searle, Doty and Mitchell complete the roster of the set list, save the anonymous writer before referred to, and of whom we said it was likely that his paper would be more than well received. To round the technical list out we have but to mention President Nettleton's address. That he can be counted on to keep up the reputation of the Nettleton family in sustaining the best interests of the Association goes without saying, and perhaps we violate a bit of confidence when reporting that he has just returned from a European trip, mainly undertaken with a view to studying the growth and spread of the manufacture of water gas on the other side; still such is the fact, and on us be the violation of our knowledge. This means that Mr. Nettleton's address is likely to be the finest number on the American's 25th meeting programme, from the technical point. The arrangements for the outing on the meeting's third day are at the point now where they may be accepted as assuring an entertainment that will be fully beyond the best expectation of any that shall attend the meeting. It is hoped that a right good number will respond to roll call, for some important matters in connection with the Association's management are certain to be considered—the Presidential succession, for instance. There can be no mistake about the naming of the place for headquarters and for the housing of those who shall be at the meeting, since the Chamberlin is altogether up to any demand that can be made upon it. It might be well, though, to secure quarters in advance.

NOTES.—Mr. Spalding denies that anyone owns the gas interests of Buffalo, N. Y., other than the capitalists with whom he is associated.——Col. Frank S. Richardson, of North Adams, Mass., has been appointed Assistant Inspector-General of the Massachusetts State militia.——It is thought that the plant of the Manitoba Gas and Electric Company, of Winnipeg, will be purchased by the proprietors of the Winnipeg Street Railway Company.

The Coal Elevating and Conveying Machinery of the Elland Gas Works.

Engineer, in describing the installation of a coal elevating and conveying plant, at the Elland (England) gas works, under the direction of Mr. Robert Porter, Engineer and Manager, says:

The coal supply for the works is brought by canal in barges alongside the Company's coal-store, and the machinery was specially designed and constructed for dealing with large coal as it comes direct from the colliery without previous treatment in a coal breaker, thus saving the extra handling and machinery required thereby. The coal in this instance is taken direct from the barges, and deposited in any part of the store in a continuous stream at the rate of 20 tons per hour when fully fed; the only hand labor required being the feeding of the coal into the elavator hopper.

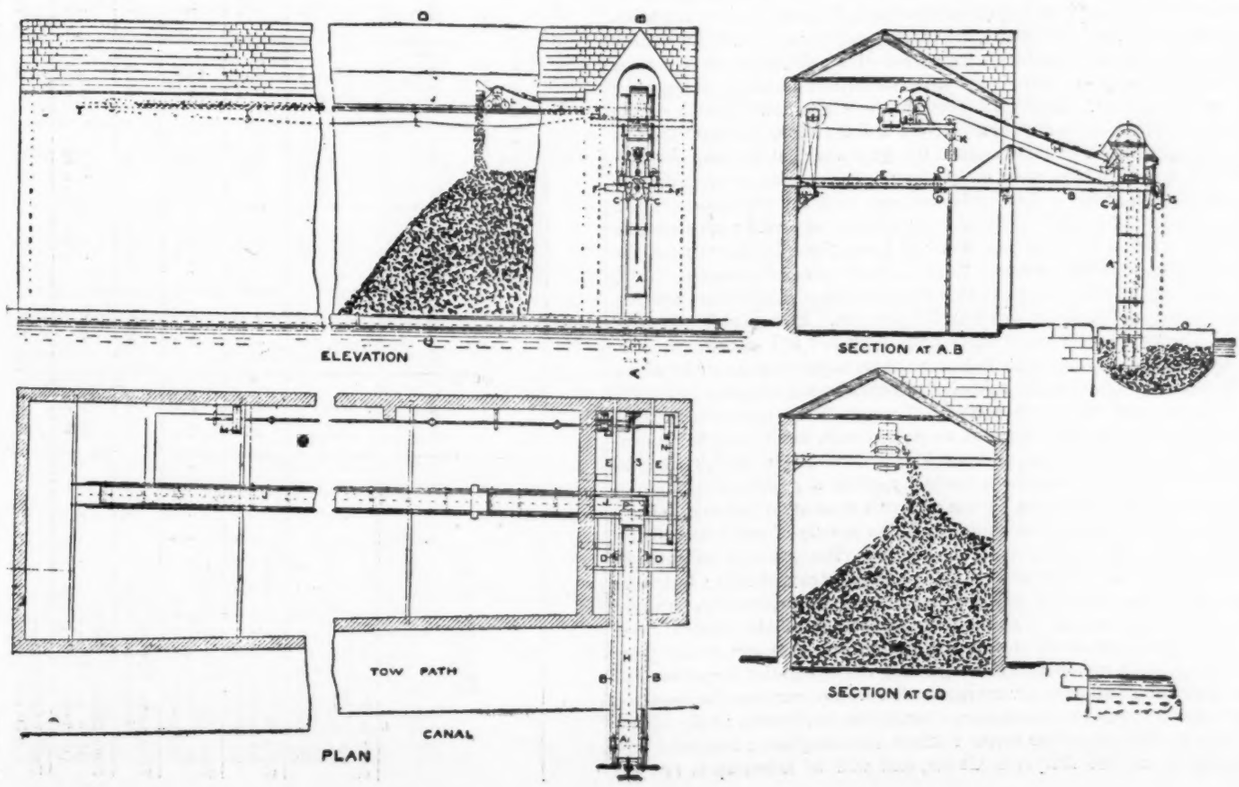
The elevating machinery and the band conveying the coal across the towpath had to be so arranged that it could rise and fall automatically with the barge, and be moved out or in across the path by power mechanism, it being necessary to leave the path clear and unobstructed after the barge was emptied. These conditions involved the application of special and ingenious arrangements of gear for hoisting and traveling motions.

The apparatus, as shown by the accompanying illustration, consists of a vertical casing or trunk *A*, constructed of wrought iron plates and angles, supported vertically by wire ropes, and attached to a pair of traveling beams *B*, as shown. The top of the elevator casing is stiffened by plates and angles for carrying the driving gear; the bottom portion being provided with a suitable hopper and tightening gear. The elevator casing is kept in a vertical position by means of strong cast iron guides *C*, having anti-friction rollers top and bottom, running on machined guide strips riveted to the casing.

The coal is raised by means of strong riveted steel buckets, 12 inches long, 10 inches wide, and 8 inches deep, attached by the ends to a double strand of chain of special make, and working over large sprocket wheels at the top and bottom; dump wheels being applied at the top to facilitate a clear discharge. The elevator casing is raised out of, or lowered into, the barge by means of special power hoisting arrangements, consisting of friction cones and miter wheels, driving a vertical square shaft, which in turn transmits its motion through worm gearing into a pair of worm wheels which are keyed on the ends of the barrel shafts on either side of the elevator, and carried by strong elbows bolted to the ends of the traveling beams. The elevator casing is suspended on each side by steel wire rope, one end of which is fastened to the under side of the beam, and the other passed round the sheave, and led on to the barrel. From the shackle to the sheave the casing is hung by chains attached to the bottom portion as shown.

The carriage *B* supporting the elevator is constructed of steel joists plated on top and strongly trussed, and provided at the back end with top and bottom anti-friction rollers *D*, which run on corresponding steel beams *E*, built into the walls of the building, and additionally supported at intervals by strong cast iron side brackets. At the front wall the traveling beams run on live rollers, carried in cast iron boxes *F* built in the wall, the boxes serving as oil reservoirs for the rollers, and insuring their efficient lubrication. The traveling beams are propelled in and out by means of a steel screw *S* of large diameter, working in a phosphor-bronze nut fitted into a cast iron stay connecting the ends of the two beams together; the power being derived from open and crossed belts from the main driving shaft situated at the back end of the elevator house. The hoisting gear is driven from the top shaft of the elevator by a short hair belt. A chain pulley *G* is also provided, geared to the square shaft by a pair of miter wheels, by means of which the elevator can be raised or lowered by manual power, in the event of the engine being stopped from any cause.

The elevator casing is formed at the top with a suitable discharging head, from which the coal is delivered over an inclined shoot with side guide plates on to an endless inclined traveling band 24 inches wide, constructed of woven material specially prepared for dealing with coal or other hard substance. The cross band conveys the coal across the tow path, and delivers it by means of suitable shoots on to another endless traveling band *J*, 24 inches wide, situated inside the building, and running the whole length of the store. The cross band is provided with a jockey pulley arrangement *K*, having weights attached, guided in channel iron uprights, which enables the band to automatically adjust itself to any position of the elevator, and maintains also a constant tension on the band. The long band *J* inside the house is supported at intervals on suitable rollers carried on channel irons, fixed to cross beams builts into the walls of the store. This band is fitted with a special throwing-off carriage *L*, so arranged that it can be moved along the store to any point, and the coal discharged on either side as desired. To take up any slacking that may occur in this band, a simple stretching gear arrangement is provided. The power for driving the apparatus is obtained from the coal-breaking engine, the belt from which drives up on to a trolley *M* (shown on the plan), keyed on to the end of a line of shafting which extends to the elevator house. The whole apparatus is driven by one main belt *N*, from the main shafting and spur and bevel gearing shown. Suitable arrangements are pro-



vided for conveniently stopping and starting the whole or any portion of the plant.

The working of the apparatus may be described as follows: The coal barge *O* being moored alongside the elevator house, the elevator casing *A* is raised off the ground, run out, by means of the screw, over the canal bank, and elevated as required to pass over the barge, on to which it is lowered where wanted. The elevator is then started to work, the two bands being set in motion at the same time. The coal is shoveled into the bottom hopper of the elevator by men in the boat; and being lifted by the buckets, it is delivered at the top on to the cross band *H*, conveyed across the tow path, and dropped on to the end of the long band *J*, which is provided with a suitable hopper *P* and side plates to lay the coal properly on to the band. The coal is then carried at right angles to its previous direction by the long band *J*, through the store, and by means of the throwing-off carriage *L* is discharged over either side into any part of the house. As the barge rises on being emptied, it lifts the elevator freely with it, the slack of the suspending wire ropes being taken up as required.

The whole of the operations are worked by power, the raising, lowering and running-out motions being easily effected by unskilled attendants.

Bye-Products and Auxiliary Materials.

The London *Journal* prints the following translation of some notes, by Dr. H. Bunte, communicated by him to last year's meeting of the German Association of Gas and Water Engineers, which has only recently appeared in the *Journal für Gasbeleuchtung und Wasserversorgung:*

Recent years have witnessed a change in the relative positions of the staple and bye-products of the gas industry. The importance of the bye-products has increased with the cheapening of gas; and at the same time carbureting materials, the rare earths, and other valuable auxiliaries to coal—the primary raw material of the industry—have come into use. With regard to the bye-products, cyanogen has lately been added to coke, tar and ammonia.

Coke is recognized as a household fuel; and its consumption as such is encouraged by those gas works which break it small. But it deserves also to be more largely used as an industrial fuel. In many towns, the much-vexed question of smoke prevention would find an easy solution in a wider use of coke. Both coke and breeze have been adopted for years as boiler fuels on gas and water works, but very rarely indeed anywhere else. Yet systematic endeavor should open up a large market for coke in this direction. The grate and hearth designed for the consumption of coal require alteration to fit them for burning coke. If such alteration is not made, attempts to use coke as fuel for boilers will generally end in failure. The heat of combustion, or the total calorific value of the coke, is the most important factor in computing its value as a fuel. Strangely enough, there are few records of the composition and calorific value of coke, and therefore the examinations of average samples of coke made at the gas works at Berlin, Breslau, Munich and Hamburg were undertaken. The results are given in the annexed table, from which it will be seen that the percentage of ash ranges from 3.7 to 11.6. The calorific value of the coke varies with its content of ash. Disregarding water and ash, the calorific value of the combustible material averages 7,783 calories per kilogramme (14,010 British thermal units per pound); and the extreme values show a difference of only 400 calories, or about 5.0 per cent. The calorific value of the different air-dried cokes varies from 6,695 to 7,268 calories per kilogramme (12,051 to 13,082 British thermal units per pound), or by about 8.5 per cent. The average value is 6,959 calories per kilogramme (12,526 British thermal units per pound). Though these figures are rather lower than the calorific value of very good coal, yet it must be remembered that the uniform and smokeless combustion which can be achieved in practice with coke renders possible a greater utilization of its heating power than can be attained with most other furnace fuels.

The value of tar and ammonia has fallen greatly of late years, owing to the competition of the coke distilleries. The price of sulphate of ammonia was first depressed by the output of nitrate of soda; but more recently it has dropped still further from over-production, brought about by the adoption of sulphate manufacture at the Scotch shale works, as well as at coke ovens and gas works. A return to the price which sulphate obtained at the beginning of the eighties is quite out of the question; and only a very moderate revenue can now be expected from gas liquor. Sal-ammoniac, ammonium carbonate, or liquid ammonia would give rather better returns than sulphate; but their production is not so simple a matter, and will be taken up at few gas

Chemical Composition and Calorific Value of Some Varieties of Gas Coke.

Description of Coke (Source of Coals).	Composition of the Air-Dried Coke.							Percentage of Combustible Material.	Fixed Carbon.	Volatile Constituents.	Calorific Value.				Calorific Value of the Combustible Portion of the Coke.			
	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Water.	Ash.				Calculated by Dulong's Method		Found by the Calorimeter.		Calculated by Dulong's Method.		Found by the Calorimeter.	
											Calories per Kilo.	B.T.U. per Pound.	Calories per Kilo.	B.T.U. per Pound.	Calories per Kilo.	B.T.U. per Pound.	Calories per Kilo.	B.T.U. per Pound.
From the District of the Ruhr—																		
(1) Consolidation Pit	85·18	0·70	2·65	1·39	0·87	1·79	7·42	90·79	90·58	0·21	6,967	12,541	7,057	12,703	7,686	13,835	7,785	14,013
(2) Rhine-Elbe and Alma Pits	85·30	0·81	3·30	1·50	0·88	1·71	6·50	91·79	89·75	2·04	6,982	12,568	7,071	12,730	7,617	13,711	7,716	13,889
(3) Ewald Pit	80·68	0·90	2·31	1·43	1·17	2·33	11·18	86·49	83·98	2·51	6,675	12,015	6,716	12,089	7,734	13,921	7,781	14,006
(4) Bonifacius Pit	82·03	1·07	2·12	1·49	1·02	1·53	10·74	87·73	84·56	3·17	6,841	12,314	6,851	12,332	7,808	14,054	7,819	14,074
From the District of the Saar—																		
(1) Camphausen Pits	82·91	1·00	1·60	1·00	1·43	1·79	10·27	87·94	85·14	2·80	6,935	12,483	6,936	12,485	7,899	14,218	7,900	14,220
(2) Heinitz Pits	88·08	0·78	1·82	1·03	0·81	0·96	6·52	92·52	91·78	0·74	7,271	13,088	7,268	13,082	7,865	14,157	7,862	14,152
From Upper Silesian Coals—																		
(1) Deutschland Pits	88·24	0·75	1·92	1·21	0·96	3·20	3·72	93·08	90·62	2·46	7,257	13,063	7,265	13,077	7,817	14,071	7,826	14,087
(2) Konigin Louise Pits	86·35	0·54	0·83	1·18	0·96	3·73	6·41	89·86	87·93	1·93	7,080	12,744	7,111	12,800	7,903	14,225	7,938	14,288
From Lower Silesian Coals— ereinigten Glückhilf Pit	82·38	0·92	1·35	0·99	1·24	1·52	11·60	86·88	85·54	1·34	6,877	12,379	6,960	12,528	7,926	14,267	8,022	14,440
From Bohemian Coals—																		
(1) Sulkov Pit	84·60	0·53	1·93	1·03	0·90	1·39	9·62	88·99	87·23	1·76	6,913	12,443	6,991	12,584	7,778	14,000	7,865	14,157
(2) Paukraz Pit	80·73	0·83	2·95	0·89	0·81	2·31	11·48	86·21	83·74	2·47	6,647	11,695	6,702	12,064	7,726	13,907	7,790	14,022
From English Coal— Pit not known	80·71	0·76	2·90	1·51	1·10	1·69	11·33	86·98	84·07	2·91	6,616	11,909	6,695	12,051	7,618	13,712	7,708	13,874

works. Under these circumstances, many works of moderate size have given up making finished ammonia products, and merely produce a concentrated gas liquor containing about 15 per cent. of ammonia. Sulphate of ammonia, on the other hand, contains about 25 per cent. of ammonia. Recently gas liquor has been largely used for producing pure liquefied ammonia for use in refrigerating machines. This ammonia is exported from Germany in large quantities, stored in wrought iron bottles, at about 200 atmosphrees pressure. There appears room for considerable extension of this use of ammonia. About 90 per cent. of the ammonia is, however, still used in the form of sulphate as a manure. Quite lately a new competitor has appeared, which may further damage the sale of sulphate for this purpose, Investigations have shown that the presence of certain bacteria in the soil enables plants to assimilate the nitrogen of the atmosphere, and to build up therefrom albuminoid substances. Thence it was not a long step to pass to the artificial infection of the soil with such bacteria. The Höchst dye works, whence tuberculin and diphtheria serum came into commerce, have produced a serum, called "Nitragin," which imparts this capacity of assimilating the nitrogen of the atmosphere to soil or roots inoculated with it. The results of the application of this serum have not so far been sufficiently definite to show whether it will actually become an active competitor of nitrate of soda and sulphate of ammonia; but experiments now being made with it ought to be closely watched by those interested in the latter commodity.

Cyanogen is the ingredient of spent oxide which has of late years been chiefly responsible for the market value of that material.[1] The demand for cyanogen was brought about by the use of potassium cyanide for extracting gold according to the MacArthur process from the South African ores. The high price of the cyanide called forth a host of inventions for its production; so that the supply is now exceeding the demand, and the value of spent oxide rich in cyanogen has fallen considerably. On the whole, the outlook is not encouraging so far as the bye products of the gas industry are concerned, but it is best to realize now the dark side of the prospect, rather than be taken unawares later on.

The auxiliary materials are a recent innovation, as till lately only coal and purifying materials were usually required in gas manufacture. Now benzol and petroleum spirit are used for enriching coal gas. The production of benzol at the coke ovens has made its general use in gas works possible, though, indeed, a rise in price has lately been witnessed, and many works have temporarily discarded it. The benzol market has always been a speculative one, and an attempt was made to regulate prices by the formation of a syndicate of buyers. Owing, however, to want of co operation, the scheme was not successful. Then the coke ovens failed to turn out the quantity expected of them. The recovery of benzol from coke oven gases was started at Dortmund by the late Herr Brunck, and was introduced by the firm of C. Otto & Co., of Dahlhausen, at several of their coke distilleries. But the firm have a duality of interests—on the one hand, new installations injure the value of their own produce; while, on the other hand, the costly installations pay a licensing fee, and hence production is restricted. These obstacles will probably soon be overcome, and then new benzol recovery works will be erected, and will fully cope with the demand.

Petroleum spirit has been much used for carbureting purposes in England and America, in place of benzol. In Germany, the duty on petroleum practically precludes its importation; and light oils of a suitable description are not made in the country. The discovery of fresh supplies of petroleum in Germany, or the abolition of the import tariff, would alter the conditions with regard to the use of petroleum spirit.

The rare earths used for the manufacture of mantles for the incandescent light are the most important recent auxiliaries of the industry Monazite from South Carolina is now extensively used for the production of thorium oxide, of which it contains only 7 per cent. The following table shows that all the mantles included in it contain about 97 per cent. of that oxide:

Composition of Some Mantles.

Name of Mantle.	Welsbach. Per Cent.	Bischoff (Fluid). Per Cent.	Meteor. Per Cent.	Siemens. Per Cent.	Weber. Per Cent.
Thorium oxide	98.8	98.9	96.6	96.0	97.8
Cerium oxide.....	1.0	1.0	1.0	3.6	1.8
Lime, magnesia, etc.	0.2	—	0.5	0.4	0.2
Yttrium oxide	—	—	1.2	—	—

Strangely enough, a mantle made of very carefully purified thorium oxide alone, gives a light of only 2½-candle power. Mantles of pure yttrium oxide only, and of cerium oxide only, are equally inefficient. But the illuminating power of the thorium oxide mantle can be at once raised by impregnating it with a solution of a cerium salt. At the time a satisfactory explanation of this strange phenomenon appears wanting. But we may hope that this portal of science too will soon be opened to us; and we may then expect a further advance in incandescent lighting.

1. Dr. Bunte is here speaking of oxide fouled under the customary Continental conditions, viz., anterior to other purifying materials, if such are used at all in the series of purifiers.—Ed. J. G. L.

The Best and Most Economical Means of Purifying Coal Gas.

[By Mr. D. M. Nelson, of Glasgow, Scotland, read before the last meeting of the North British Association of Gas Managers.]

The Executive of our Association, in providing a title for the subject matter of this paper, has suggested a task of a somewhat pretentious nature, and one very difficult, if not impossible, of performance, as he would be a bold man indeed and clever who would arrogate to himself the capacity of being able to propound to a body of directly practical men such as are here assembled, the dogmas of what are the best and the most economical means of accomplishing the purification of coal gas, or indeed of any one thing upon which so many experiences differ, and what are embraced in the huge catalogue of gas manufacturing expedients, especially in relation to the perplexing process of thoroughly removing what are known as the common chemical impurities from coal gas to be employed for illuminating purposes. It goes without saying that it is of the utmost importance that the highest chemical knowledge and most indomitable perseverance should be brought to bear upon this department of the gas industry; for upon the purity and high illuminating power and the moderate cost of coal gas will depend its power to resist the encroachments of its electric competitor—a rival which, thanks to public favor, "wet nursing," and fostering care such as the introduction of gas never enjoyed, is making itself more felt as time goes on. For while there are those who say that gas interests have not suffered by the introduction of the electric light, there are others who know that its safety so far has been owing to the additional uses to which it can be put, such as for cooking, heating and motive power; also to its higher illuminating efficiency with incandescent systems of lighting. These have done more than anything else to stop the raid upon the gas preserves by the sharp-shooting electric lighters. They have tended to increase the manufacture, and consequently reduce the cost of gas, the low price of which to the ordinary consumer has undoubtedly induced him to substitute large for small burners, and thus to consume more of it; lowering the illuminating power rendering this imperative if a satisfactory light is to be obtained.

If electric lighting has done nothing else, it has been of incalculable value to the gas industry, which for long lay somewhat dormant, in stirring up the latent energy and sharpening the wits of those controlling gas undertakings to scheme ways and means of cheapening and perfecting the production of what is, all things considered, the very best form of artificial lighting. The possibilities of gas production and supply are far-reaching; and it is no rashness to prophesy that ere many years have passed we shall have the gas supply free of charge—an impossibility in the case of electricity, as this costs money to produce, and is devoid of residuals. Coal must be distilled for the sake of its numerous commercially valuable products, a moderate increase upon the selling price of which would, in the case of a city like Glasgow, enable the municipal authority to give gas free, and to feel obliged to the public for consuming it at their burners; this being the very best means of disposing of it, as it could not be safely discharged into the atmosphere. Thus the present enormous expenditure upon meters and the collection of gas rates, etc., which are mainly what the public pay for under the name of gas supply, would be no longer necessary.

A good many years have elapsed since the speaker last discoursed to the members of this Association on the subject of gas purification by means of oxide of iron. Since then, many materials and methods have been tried with a view to lessen the cost and improve the labor of purification; but perhaps with the exception of lime and oxide of iron, all have been more or less only partially successful. These two materials have, better than any others, maintained, and in some respects improved, their hold upon gas managers, until it might now be said that they are the very best materials that can be employed for the purpose of gas purification, whether used singly or together. The object of this paper is to afford evidence that lime used in conjunction with oxide of iron instead of, as is commonly the case, being employed exclusively, is the "best and most economical means of purifying coal gas."

Neither material is, by itself, a perfect or complete performer of the duty of purification ; yet together they contain all the elements requisite, and when united as fellow-workers can be made to perform the service of purifying agents better and more economically than any other substances known at the present day. While complaints may be made in respect of both materials that they are at times of an inferior character, and do not perform the allotted amount of duty expected of them, the faults may not lie in the materials at all, for even the very best material improperly treated will show no greater efficiency than inferior stuff. Much care and skill are therefore required in the choice, preparation and treatment of the less well known material, bog ore. This is exemplified when it is found that in dividing a cargo of uniform quality over half a dozen different works, although in the same district, and using similar mixtures of coal, very different qualities of gas, and different costs per million cubic feet for purification, will be found. Doubtless there are local causes—such as arrangement, and limited dimensions of apparatus—to largely account for these differences. Still a lengthened study and experience points to the conclusion that individual skill has much to do with the successful issue.

As this subject does not readily lend itself to diagrams or illustrations, this paper will only serve to point out shortly, and in a simple way, the application of lime and oxide of iron, especially the latter, which is not sufficiently well known or so largely employed in Scotland as its merits deserve ; preferring to leave an opportunity for inquiry and discussion at the close of the paper, which, after all, is the most direct means of gaining information.

The extreme difficulty gas managers experience in getting rid of their spent lime must be the writer's excuse, to some extent, for bringing the application of oxide prominently before the Association; and were it not that great advances have been made and profit largely reaped by its extended use in recent years, the results of which will be shown presently, it would be injudicious to interfere where lime is an old and all-round useful servant, such as it has proved itself to be in the economy of gas manufacture ; and it will be a powerful rival indeed that will displace it in the estimation of gas managers. Yet, from no fault of its own, but because of the increased excellence of condensing, scrubbing and washing apparatus, lime in a fouled condition does not now possess the value it formerly did. The time was when the crude gases were very imperfectly scrubbed or washed ; much of the ammonia finding its way to the lime in the purifiers, and thence with it to the agricultural land, where its enrichment of the soil was a welcome help and means of profit to the farmer, and also a source of revenue to the gas authority —from $1.25 to $1.75 a load being got for it. But the ample and perfect apparatus now employed cuts off and deprives the lime of such nutritive value ; so that it has become really a waste product in the literal sense of the term, as farmers will not take the stuff, even as a gift, from such well-appointed gas works. Indeed, many managers have to load it up for nothing. What with the too abundant supply and consequent low price of sulphate of ammonia ($37.50), managers so circumstanced with their spent lime, might consider the feasibility of charging it with ammoniacal properties sufficient to render the stuff a marketable article and remunerative bye-product. Times are changed from those when sulphate sold at $100 per ton. It is, however, no design of this paper to stimulate the use of spent lime, or to fortify or set it up as a rival to spent oxide, for which there is a good demand, and a profitable return to the gas authority, because of its richness in sulphur compounds and cyanides. For while the lime is now being deprived of that which would enhance its value as a fertilizer, oxide of iron is, on the contrary, being charged to its fullest capacity with so-called chemical impurities, the extraction of which by chemical experts in this country, but more largely and to greater profit on the Continent, has raised this product to the position of being an important article of commerce, and of regular marketable value.

From the foregoing it would appear as if the wrong end of the subject has been given first. But the object has been to at once enlist an interest in the matter and prepare the hearer for the somewhat dry facts of the results of practical working and the economies and profits arising therefrom which will be stated very briefly.

As regards lime, it would be egotism on the writer's part to occupy the time of the meeting with any description bearing upon the selection, preparation, or treatment of it. Allusion need only be made to it in its relation to and behavior with oxide of iron. One of our Past-Presidents—a gentleman well qualified to pronounce an opinion on this subject—when addressing us some years ago, said: "All things considered, in a matter of purification, advantage must be taken of the better knowledge and greater experience now prevailing to cheapen the process by using large purifiers in order to effect the most efficient combination between the purifying materials and the impurities we wish to remove, by passing the gas *slowly* through." This meant, as a matter of course, that purifiers should be ample in capacity, and have large purifying area, especially surface, for the gas to act upon. Undoubtedly this is now an ascertained fact, and accounts for the recent demand on all hands for larger purifiers ; surface area rather than depth being the chief consideration. The difficulty is in knowing when purifiers are deficient, merely sufficient, or ample in capacity. It would be impossible for any writer of a paper to dictate as to this. Each district has its own special difficulties to be considered and local circumstances to contend with, such as in the matters of quality of coal, its distillation into gas, and the kind and quantity of purifying materials employed ; also, as already suggested, the nature and efficiency of the other condensing and scrubbing plant upon the works.

But for the purposes of illustration we may select any gas works in Scotland producing up to 50 or 60,000,000 cubic feet of gas per annum. The proportion of lime and oxide required, will vary according as the impurities in the coal predominate—a large proportion of first class lime being required where carbonic acid is found largely in excess, and a due proportion of oxide where sulphur compounds are too abundant, which when permitted to escape in the form of sulphureted hydrogen contaminate the atmosphere and injure the valuables of our dwellings. Carbonic acid gas being less perceptible by the sense of smell, is none the less objectionable because of its poisonous nature, and the deleterious part it plays with the illuminating power of the gas. Our present purpose will be served by dealing with these two broadly-defined impurities, rather than by going into the other and more complex *minutiæ*.

Assuming that four purifiers are in use, although oxide can be, and is profitably employed in small works, where only two purifiers are in operation, it is a distinct advantage to have, in addition to these four, an initial (or catch) purifier, the object of which is to receive the crude gas passing from the washer (or the scrubber, if there is no washer). This gas, in passing through the oxide in this purifier, is, by a kind of filtering through the soft, fibry porous oxide, relieved of whatever tarry particles it may carry by escape through the washing process, and this prevents such particles from reaching the lime, where they would, from their glutinous nature, form an impenetrable skin or crust on the surface of the material ; thereby preventing the gas finding or forcing its way through the mass, but rather causing it, because of this obstacle, to uselessly spread itself, and pass up or down as the travel might be, the side and end spaces of the purifier boxes, without going as noted through the mass of purifying metal. As will at once suggest itself, the gas at this stage and in the crude condition is largely charged with sulphur compounds, for which oxide of iron has a great affinity—indeed, a much greater affinity than has lime. Being relieved of the tarry particles and sulphur compounds, the gas will thus pass on to the lime in a semi-clean condition ; giving the moist lime only the work of absorbing the carbonic acid for which it is specially useful.

It will thus be seen that the two materials acting in succession more fully discharge the duty of complete purification than either could accomplish it separately. Three purifiers (one oxide and two lime) may be worked to great advantage where four purifiers are not available ; but as already indicated, the service of a catch purifier and four purifiers, would be more thorough, and of greatly increased efficiency. They could be worked in the following rotation : The gas will first pass through the catch purifier (No. 1), and then enter No. 2, which by preference should also contain oxide, so as to exchange with No. 1 in the renewal. Nos. 3 and 4, also No. 5 lime. If the arrangement of valves admits of all three being in use at one time when necessary, so much the better ; the writer's desire being to avoid the change of lime as long as possible. The oxide requires fewer changes than lime ; indeed, where lime needs renewal once in every eight or ten days, oxide may remain undisturbed for as many weeks. It will be seen that the action of the oxide upon the crude or dirty gas is a distinct gain, and has the effect of prolonging the purity and life of the lime, and therefore its active usefulness, to a very great extent—indeed, to an extent quite unknown prior to the introduction of oxide—and goes far to reduce the quantity of lime used in the course of the year. It may be remarked, in passing, that while lime is exhausted and removed as foul and useless after an interval of eight or ten days, oxide only requires to be removed after lengthened periods of work ; and by exposure to the atmosphere, by being spread out for the elimination of the free sulphur, it is revivified, and returned to the purifiers to do further duty. This goes on for a period of several years, until the oxide is fully charged with sulphur and other chemical compounds, which render it an article of considerable value to the chemi-

cal manufacturer, and of profit to the seller. Even a casual observer will at once see the enormous saving in labor effected when oxide and lime are used in conjunction, as compared with the use of lime alone, not to speak of the substantial gain in comfort and convenience through the less frequent discharge of noxious pungent vapors into the atmosphere, to the annoyance of the surrounding amenities, when the purifiers are being changed.

It would detain this meeting too long to follow the complete process of purification from the start to the finish, and to enlarge upon the benefits and economy derived from the use of lime and oxide in combination, and as an ounce of practical result is worth any quantity of specious averment, the following abstract statement will doubtless be of interest to managers who have not succeeded so well, and act as a stimulus to others who have not yet fairly or fully considered the subject, but have rather viewed the oxide of iron process of purification through the arguments of a prejudiced medium. The instance about to be quoted is a hard substantial fact, away from the domain of romance. It relates to an ancient town where more than ordinary difficulties have been experienced in the manufacture of gas, and doubtless to these very difficulties may be attributed the zeal and skill displayed in surmounting them. At any rate, the writer's knowledge of this town's gas works goes back much farther than 1875, prior to which year lime alone was used. The cost, *exclusive* of labor, was 4 cents per 1,000 cubic feet of gas made. During the intervening period—1875 to 1890—many experiments and methods were tried, with somewhat encouraging results, all tending to improve and lower the cost of purification, until something like 1 cent was the cost per 1,000 cubic feet *inclusive* of the cost of labor. In 1890 a definite course of using oxide with lime was established (it had been going on only intermittently before), employing about equal proportions. The effect was to reduce the expense of purification in that year to .8 cent per 1,000 cubic feet, including the cost of labor, or a saving of 3.2 cents per 1,000 cubic feet against the earlier use of lime alone. In 1896, using lime and oxide as before, but revivifying the oxide *in situ* instead of taking it out, through the introduction of about 1 per cent. of atmospheric air at the inlet of the purifiers, reduced the cost of purification, including all labor, deterioration of the oxide, which then contained 59 per cent. of fixed sulphur, and the upkeep of the air apparatus, to .346 cent per 1,000 cubic feet. A new set of larger purifiers, and a fresh supply of the natural oxide of iron have recently been put in operation, and with these the Manager intends working during the ensuing winter; and he feels no hesitation in saying that they will beat their last year's low record in purifying say 40,000,000 cubic feet, for something under $95, or ¼ cent per 1,000 cubic feet.

Of the many experiences—more or less good—the foregoing is certainly an "eye-opener;" and the fact that gas is of greater purity, and frequently of higher illuminating power, from works where oxide is used in conjunction with lime, may be assigned as a good reason why oxide should be more generally adopted. Although the increase, in the writer's experience, has been very encouraging, still it may frankly be stated that, from causes which might be easily surmounted, oxide has not had so much attention given to it, or the trouble taken with its use, as it deserves; and the fact that, in a works whose operations have been beset with many drawbacks, the cost of purification should be brought down, by patient and persevering skill, from 4 cents to less than 3-8ths cent is indeed phenomenal, and, considering that the illuminating quality of the gas is fully maintained, is highly creditable to the management.

Painting Buildings by Compressed Air.

The following interesting description, by Mr. J. J. Hubbell, is taken from the Michigan Engineers' Annual for 1897:

The buildings belong to the Buckley & Douglas Lumber Company, and included a main building 475 feet long by 356 feet wide. The structures covered about five acres and there was fully 1,000 "squares" or 100,000 square feet of surface to be covered with paint. Rough hemlock lumber was used in the sides of these buildings, and the problem was to cover this siding with some preservative compound as cheaply as possible. After a full consideration of various washes, a mixture of good raw linseed oil and red oxide of iron was determined on.

Bids were received from three local painters. One of these offered to furnish brushes and ladders and to apply the paint for 35 cents per square; another offered so do it for 28 cents if the Company provided all material, and the third made a lump bid of $300 for providing labor alone. Each of these bids was reasonable, but all of the painters deemed two coats necessary and thought the season too far advanced to undertake the work at the time. In this emergency Mr. Hubbell determined to use compressed air for the work.

He made his own sprayer at a cost of $10, and in addition provided 150 feet of ¾-inch hose, an air pump taken from a locomotive and an air reservoir also taken from a locomotive. This latter had a capacity of 10 cubic feet and was placed near the large building and connected to the air pump by ¼-inch gas pipe. He says that he should have used ¾-inch pipe, but the smaller pipe was on hand in quantities. Of the hose, 125 feet were to connect the nozzle with the air reservoir and 25 feet to connect the nozzle with the paint bucket, the latter being elevated to about the level of the nozzle.

The paint came in barrels of 50 gallons each, and to each head of these barrels was screwed an iron flange with a short journal attached. The barrel was hung on these journals and revolved by a crank so as to thoroughly mix the paint, which was then drawn off by a molasses gate set in the side of the barrel, two or three gallons at a time. In use the air pressure ranged from 40 to 50 pounds, and as the air passed through the nozzle it sprayed the paint in a fine cloud looking like a jet of red vapor. The discharge was controlled by a valve in the base of the nozzle and the operator soon became expert and could paint 8 or 10 feet above his head and the same distance below his feet. Two men were required, one to keep the paint bucket full and the other to handle the brush. There was little waste of paint, though every crevice was filled, and the rough surface was covered better than it could have been done by hand. One gallon of paint would cover about 150 square feet, and the two men would cover about 5,000 square feet in one day. The windows were protected by a light moveable canvas covered frame.

The cost of the oil paint thus applied did not exceed 10 cents per 100 square feet, and the cost of painting the buildings, including all labor and a reasonable sum for the use of the air pump, pipe, reservoir and brush, was less than 15 cents per square of 100 square feet, or less than one half the cost of painting by hand.

Mayor McMurray's Veto of the Opposition Charter for Denver, Col.

The following is the text of the veto, by Mr. T. S. McMurray, Mayor of Denver, Col., under which he disapproves the action of the Denver City Council, in granting a franchise to the projectors of the Peoples Gas, Heat, Light and Power Company for the operation of an opposition gas works in Denver?

To the Honorable the City Council of the City of Denver: Gentlemen—I return you herewith, without my approval, Aldermanic bill No. 26, introduced by Alderman Newton, as amended by the Board of Aldermen, being "A bill for an ordinance granting to the Peoples Gas, Heat, Light and Power Company, a corporation, the right to lay, construct, maintain, operate and use pipes and other appliances for the distribution of gas in certain streets, avenues, highways, alleys and public grounds of the city of Denver."

This bill proposes to grant a franchise for 20 years to the Peoples Gas, Heat, Light and Power Company, to supply the citizens of Denver with gas for light, heat and power purposes, upon certain terms and conditions set forth in the bill.

Many statements have been made publicly and privately as to what this Company would do for the privileges proposed to be granted. Any public or private assertion as to what will be done, is worthy of very little consideration, unless provided for in the bill itself. A franchise being granted upon certain express conditions, promises made outside of the ordinance granting the franchise would not be binding and cannot be considered in the discussion of this subject.

There are two legal objections to the bill, to which I wish to call your attention, and, at the same time, say to you that had I no other objection than these, I would not withhold my approval of the bill on this account, but would let those questions be determined by a court of competent jurisdiction.

I consider it my duty, however, to point out to you these objections in order that you may be advised of the circumstances. I am not willing to veto a bill and hide behind a mere technical objection, but am prepared to give reasons for the position I take, and submit to the candid judgment of yourselves and of the public at large the question of the strength of these objections.

I will notice briefly the objection made by the city attorney publicly, that the bill did not properly pass the Board of Aldermen. In my judgment the point of the city attorney is not well taken because he proceeds upon a promise that does not exist. The bill was introduced

in the Board of Aldermen and referred to and considered by a regular committee, besides the reference to the committee of the whole, of which the city attorney speaks. The bill was afterwards properly passed, I think, in the Board of Aldermen, but coming into the Board of Supervisors, I think a technical objection exists against the way in which the bill was reported to have passed that body. It was referred to a committee and a report made by that committee was presented to the Board of Supervisors, but no motion to discharge the committee appears of record. It is a serious question in my mind whether or not the bill has ever properly come out of the hands of that committee, no report of the committee having been adopted and no motion made to take it out of the hands of the committee. This, however, is merely a question of procedure, and could properly be left for the future adjudication, were the bill otherwise unobjectionable.

The bill purports to grant a franchise to lay, construct and maintain gas pipes in the public parks and squares of the city of Denver.

This is an absolute violation of the charter, and beyond the power of the Council to grant; the charter expressly providing that the Council has no power to grant special privileges or franchises in the parks, but that those grounds are under the exclusive control of the park commission.

Laying aside these technical objections let us proceed to consider the bill upon the merits of the question itself. It seemed to me that there were two questions which must be determined before I could give my consent to this bill.

First.—Is the bill properly drawn so as to protect the interests of the city? Are the resolutions therein contained sufficient to give the city due consideration for the rights and franchises granted? And is there any assurance that the benefits promised in return for the granting of the franchise will be received by the citizens of Denver?

Second.—Will the approval of this bill hinder or promote the municipal ownership of a gas plant in the city of Denver?

In proceeding to the determination of the first question it seems to me that I must meet the proposition as to whether this Company is so organized financially that, if the franchise is granted, it can immediately proceed to carry out the terms and provisions of the bill, or is the franchise sought for speculative purposes in order that it may be sold either to the old Gas Company or to the highest bidder for the privileges therein contained?

There seems to be a determination all through the bill to avoid binding the Company to anything more than was absolutely necessary to obtain the passage of the bill. If the bill is granted for speculative purposes, either to enable these people to sell out to the old Gas Company, or to hawk the franchise around and dispose of it to the highest bidder, there is no question in my mind that I should withhold my approval to the bill. The city of Denver has no right to grant a franchise to a private corporation to speculate upon. If the franchise is to be offered to the highest bidder, why not prepare the bill ourselves with all the proper restrictions to protect the interests of the citizens, both as to the question of rates and payments to the city and terms and conditions upon which the rights granted are to be exercised, and then offer it to the highest bidder that the city may get the benefit of any profit there may be in it, and not a private corporation?

I have carefully examined this question. I have had conferences with the gentlemen representing this Company and have failed to receive from any of them the assurance that a single dollar of capital has been paid in available for future work. One of the promoters of the enterprise stated publicly before the City Council that he wanted plenty of time before the Company would have to commence work in order that the franchise might be taken East and money raised upon it. Other gentlemen have stated to me personally that the only thing they have in sight is the property of the Steam Heating Company, which they claim cost over $300,000, and a block of ground which has been turned over to this new Company in exchange for $65,000 worth of stock, when the real estate itself is not worth more than one-half of that amount of money. This does not give us any assurance of a *bona fide* enterprise, and besides, perhaps, I cannot altogether free my mind from a well-grounded suspicion that the bill is intended for sale by reason of the fact that I have seen a letter from one of the prominent stockholders of the Steam Heating Company, which is practically the same Company as the one that seeks this franchise, proposing that the old Gas Company should help to obtain this franchise on the theory that, if granted by the city, it would prevent future applications for many years to come, and proposing the terms and conditions upon which the franchise, when obtained, should be transferred to the Denver Consolidated Gas Company.

This may not be the intention of all of the promoters of the Company seeking this franchise, but such a proposition has been made, and necessarily must create some suspicion in my mind that the enterprise is not in good faith, but is intended for speculative purposes.

In view of these facts the refusal of the grantees under this proposed franchise to submit to such reasonable restrictions as would absolutely guarantee the carrying into operation of an opposition gas plant in this city, and assure to the citizens the benefit of cheaper gas, seems to add to the doubt which I had as to whether the benefits proposed in this bill can be guaranteed and secured to our citizens.

The city of Denver has about 800 miles of streets. The old Gas Company covers in the neighborhood of 90 miles. This bill provides for the construction of 10 miles annually until 50 miles have been laid. This would not give many citizens of Denver the benefits of the ordinance. The business portion of the city alone would receive the benefits of cheap gas under this bill, even if the Company should go ahead in good faith, construct the plant and furnish gas. At the end of five years, under the provisions of the bill, but a very small portion of the city would be covered, and we would have the same state of affairs as we can remember existed during the water company fight, in which the people who were fortunate enough to live upon streets that had double lines of mains received the benefit of that competition, while the people who lived on the lines of the old Company, where they were not paralleled with the new, paid full prices for the water.

Under this bill, therefore, I am very much afraid that only a very small portion of the city would receive the benefits of competition, while the great mass of our citizens would continue to pay the old rates for gas, because there happened to be no competition in their part of the city.

The right granted by this bill to use the Steam Heating Company's plant, 6 miles in extent, only makes it necessary for this Company to lay 4 miles of pipes, at an expense probably of $16,000, as 6-inch pipe can be laid for about 80 cents a foot, to fulfill the obligations of this bill for the first year, and as the deposit of $25,000 guaranteed by the bill is to be returned to the Company when 10 miles of mains are in operation, we can readily see that but very little money need be expended in order to hold this franchise in selling shape for a considerable length of time.

The provisions of this bill granting the franchise take special care to include not only the grantee named in the bill but its successors and assigns, while every provision of the bill fixing an obligation upon the Company expressly leaves out the words "successors and assigns," thus making the obligation upon the grantee of this bill only and having no binding force upon its successors.

Section 7, providing the price at which gas shall be furnished, simply provides that the Peoples Gas, Heat, Light and Power Company shall supply gas, no reference whatever being made to its successors and assigns.

Section 8, which provides for the payment to the city of 3 per cent. of its annual gross receipts, simply provides that 3 per cent. shall be paid by the Peoples Gas, Heat, Light and Power Company, no mention whatever being made of successors or assigns.

Section 9 provides that the city shall pass all ordinances that may be necessary to protect this Company in its operations, but expressly refrains from reserving to the city the right to pass any ordinance that would protect the citizens of Denver against any unauthorized use of this franchise by the Company.

Section 10 provides that the right of the employees of the Company to excavate in the streets shall not be prohibited by the city, thus bringing up exactly the same question that this administration has in controversy at the present time in the courts with the water company.

Why should we not reserve to the city the right to pass any ordinance that might be considered necessary to protect our citizens, and why should we not reserve the right to prohibit excavation in the streets, if it is afterwards considered best so to do?

Section 12 provides for municipal ownership after five years. It seems to me this provision for municipal ownership should run through the entire life of the franchise, and I see no reason for postponing our operations for the term of five years.

Section 15 provides that the Company shall execute a bond to secure the city against any delay in using the franchise granted, but the bill, instead of fixing the amount of this bond, provides that it is hereafter to be fixed by the Mayor and City Council. It seems to me that this is a subterfuge to obtain further time. It would have been easy to have fixed the amount of the bond in the bill, then we could have demanded the bond at once. Now the Company would be entitled to delay, pending the fixing of the amount of the bond by the Council.

Section 16 and Section 17 are the sections which are intended to pre-

vent consolidation, but the prohibition extends only to the "rights, franchises and concessions," and does not refer to the property and plant. The consent of the Council will give the right to consolidation of everything, and it is not provided that it must be by ordinance, consequently it can be done without the consent of the Mayor. Neither of these two sections prohibits the sale of the property, and the only forfeiture contained in them is that of the franchise. If this Company should at any time desire to sell out to the Denver Consolidated Gas Company, that Company purchasing would desire this franchise to be forfeited, because it would have a franchise of its own, under which it could do business, that would not be subjected to the limitation of rights nor the payment of royalty to the city that this bill would provide, consequently the sale of property would be all of value that the Company would have if it were dealing with the old Company.

Section 18 provides for the deposit of $25,000 in bonds, but it does not state when the deposit shall be made. It also provides that if the Company shall have 10 miles of mains in operation within a year, including the 6 miles of the steam heating plant, the deposit shall be returned to the Company, thus leaving no further guarantee to protect the city, except the forfeiture of the franchise, which, as I have before pointed out, would be valueless in case of a sale to the old Company. The objections to the bill itself will, I trust, commend themselves to your judgment.

And now proceeding to the second question affecting the municipal ownership of a gas plant in Denver, brings me to what I consider the most important phase of this subject.

This administration was elected upon the principle that all public utilities, as far as possible, should be owned by the people, and that franchises belonged to the people in their corporate capacity. I believe, gentlemen, you will agree with me that if we can have municipal ownership of a gas plant in the city of Denver, it would be unwise to grant any further franchises for that purpose. The experience of the past teaches us that where opposition franchises are granted it simply means a war of competition for a little while, and then the weaker company goes to the wall and the public foot the bills. This has been the case with the water companies, and the very fact that there were two companies which afterwards consolidated themselves, vastly increasing the bonded debt and capitalization of the new company, renders it more difficult at the present time for the city to obtain control of a water works system of its own. Would we not have the same experience with the Gas Company? History answers "Yes." An opposition franchise for gas was granted some five or six years ago, and after a short duration the new Company sold out to the old, and I have no doubt that the amount paid for the franchise granted under the plea of competition now forms an important part of the capitalization of the present Gas Company. Do we wish to repeat this experience? I think not I wish to say here what I have said upon other occasions, that a careful study of this question has convinced me beyond the possibility of a doubt that all of these public utilities should be owned by the city.

Denver has pronounced in favor of this proposition. Revolutions do not go backward. These great movements must move onward, and it is our bounden duty, elected upon a platform calling for municipal ownership of public utilities, to see to it that we cast no stumbling block in the attainment of that desired end. Should this bill become a law, I believe that it would hinder and delay municipal ownership. It seems to me that we can obtain control of the plant of the present Company and have it operated by the city itself; then if there is any opportunity to give cheap gas to our citizens we can demonstrate the fact beyond peradventure. I have personally used my utmost endeavor to obtain something that would give us the assurance of acquiring this plant for the city. If the city should own the present Gas Company's plant and can operate it at a price to give cheap gas to our citizens, and certainly we can operate it as cheaply as any corporation can, then all of our citizens now using gas will receive the benefit of the reduction, while under the new bill simply that portion of our city that is covered with duplicate pipes will get the benefit, which would probably be only a small portion of the business center of the city for some time yet to come.

A difficulty exists as to the purchase of a gas plant. I recognize as well as anyone the fact that under the constitutional prohibitions as to the limitations of indebtedness it may be some time before the city of Denver can purchase a plant, because the amount of money required would bring us beyond the constitutional limit of indebtedness; but there is no reason why we should not lease and operate a plant if we can obtain one in that way. I believe that under the present charter we have power to enter into a contract of this kind, but even if that should be found not to be the case, there being no constitutional prohibition, an amendment to the city charter could be obtained expressly granting that power.

After considerable effort I have succeeded in obtaining from the Denver Consolidated Gas Company an option covering both purchase and lease of its plant and facilities upon the basis of an appraised valuation, which I attach herewith, and make part of this message. This option continues until July 1, 1901, and thereafter until revoked by 60 days' written notice, thus extending over two different legislative assemblies and covering two city administrations besides the present one.

In connection therewith I have secured an obligation from the Company, for a reduction in the price of illuminating gas, on and after January 1, 1898, to $1.25 per 1,000 net, and after the consumption of gas shall have reached 350,000,000 feet per annum the price is to be reduced to $1 per 1,000 net, provided of course that point is reached before the city's lease is consummated.

This reduction would apply to all consumers of gas, and not merely to the small district covered by 10 miles of mains prorosed to be laid under the new bill. It seems to me that the acceptance of this option and the leasing of the plant of the Denver Consolidated Gas Company to the city of Denver, and its operation by the city bring us practically to the desired end of municipal ownership at once, or at least in the very near future, and in my judgment is far more in the interest of all of the consumers of gas in the city of Denver, as well as of all of our other citizens who may not be gas consumers, than would be given by the passage of Aldermanic Bill No. 26.

I, therefore, decline to give my approval to this bill, and in lieu thereof earnestly recommend the acceptance of the proposition to lease the plant of the Denver Consolidated Gas Company at as early a date as possible, so that this administration may give to our citizens the first illustration of municipal ownership of public utilities. I recommend that the matter be taken up with the City Attorney to prepare a proper ordinance providing for carrying into effect the proposition hereinbefore referred to.

Thus Denver will take its first step upon the road leading to ownership of all public utilities, and whatever profit there may be in the operation of these privileges will inure to the benefit of our own citizens rather than to corporate capital.

Trusting that your honorable bodies will concur with me in the proposition I have laid down, and assuring you of my hearty co-operation in the preparation of the proper ordinances governing this subject, I return Aldermanic Bill No. 26 herewith to you without my approval.

The Offer of the Denver Consolidated Gas Company to the City.

The following is the proposition of the Board of Directors of the Consolidated Gas Company to the city of Denver, referred to in Mayor McMurray's veto message; the proposition, however, is subject to the ratification of the shareholders of said Company at a meeting to be held next month:

"The Company will give to the city an option to purchase the Company's plant, property and franchises, at a valuation to be determined by agreement, or, in case of disagreement, by the decision of one or more competent and disinterested umpires; or, at the election of the city, the Company will give an option to lease, for a period of not less than eight (8) years, the plant and facilities of the Company, at an annual rental of 6 per cent. on such valuation, said rental to be payable in equal quarter-yearly instalments.

"Said option to purchase or to lease shall continue until July 1, 1901, and thereafter until revoked by sixty (60) days notice in writing given to the city by the Company.

"In the meantime the Company will reduce its charges for illuminating gas so that the same shall not exceed the following rates, to wit: One dollar and twenty-five cents ($1.25) per 1,000 feet, from January 1, 1898, until such time as the total annual consumption of gas from the Company's plant or plants shall equal 350,000,000 cubic feet.

"One dollar ($1) per 1,000 feet thereafter so long as the annual consumption shall equal or exceed 350,000,000 feet. The charge for fuel gas at no time to exceed $1 per 1,000 feet. To which rates, however, penalties may be added on default in prompt payment.

"*Provided*, however, That said option to purchase or to lease shall terminate, and all agreements herein contained shall be void, in the event of, and upon, the granting by the city, by ordinance, or otherwise, to any company, person or persons, of a franchise or right to manufacture, sell, or distribute gas within the city of Denver.

"Upon the acceptance of this proposition by the city, and its ratifi-

cation by the stockholders of the Denver Consolidated Gas Company, the same shall be embodied in an ordinance amendatory of ordinance No. 128, of 1891, granting rights to said Company.

(Signed) "THE DENVER CONSOLIDATED GAS COMPANY.

"By J. B. GRANT, President.

"Attest, F. W. HERBERT, Secretary."

Utilization of Exhaust Steam in Electric Stations.

By MR. GEORGE L. THAYER.

In four-fifths of the electric light stations we are wasting a bye-product of greater relative value than is the case with any other industrial concern. The exhaust steam carries away 85 per cent. of the heat supplied by the boilers. The problem confronting the station manager of the day is this: Can this stream of energy now being wasted be put to some use, and, if so, will it pay to do it? This question can hardly be answered off-hand, but I wish to say that, generally speaking, there is no extension of your business that will pay larger profits on the investment than that of steam heating.

The author then gave brief descriptions of the gravity and vacuum systems of steam distribution, and mentioned the American District Steam Company, of Lockport, N. Y., as the pioneers in central station heating work.

It may seem strange but it is an actual fact that a gravity plant can be changed into a vacuum system and the coal consumption reduced considerably, and that, too, with better results in heating. When the boiler feed-water is of a bad quality it will pay to return the water of condensation. Where a good grade of cylinder oil is used there will be no difficulty with the very small amount of oil coming from the heating system. There will be enough fresh feed-water added to prevent any trouble which would come from using distilled water in the boilers. It is needless to say that corrosion and scaling, with their attendant expense, will be largely reduced. However, the loss through wasting the condensed water is not as great as may seem at first. The condensation can be led into an indirect radiator and used to heat the fresh air from outside. The water leaving the coil will have all available heat removed. If, on the other hand, the condensation at 212° be returned to the boiler the radiation loss in the returns may be more than the heat wasted when the water is discharged from the system.

The correct design and construction of the underground mains is a vital point if the system is to be made a success. It is necessary to secure three results. The radiation losses must be small; unless the distance run is excessive they should fall within 5 per cent. of the total system supplied. Expansion and contraction should be provided for. Assuming a range in temperature from 50° to 212°, 100 feet of main will expand 1⅛ inches. In a long line of pipe this becomes a serious matter. The mains should be protected from surface water as the pipes are soon corroded through when the pipe covering becomes damp. One standard method of construction is as follows:

At the bottom of the trench is laid a tile drain. Pine logs are bored and the outside surface painted with asphaltum, These are tenoned together and the iron pipe having received its covering is placed inside. Expansion is provided for by a special fitting having a flexible diaphragm doing away with a stuffing box. Service connections are made every 50 feet. The work is simplified by there being no return pipe.

Another method which seems to be successful is to build a box of tarred boards. The pipes are supported a few inches above the bottom of the box to protect them from water which may accumulate at the bottom.

The box is filled with asbestos wool or each pipe is covered with common pipe covering. Expansion is provided for either by expansion joints placed in manholes or, where the pipe is small, by U-shaped offset loops. Whatever method is followed it pays in the long run to have the work well done.

I am indebted to Prof. R. C. Carpenter, of Cornell University, for the following data on condensation in steam pipes: The various university buildings are heated from one boiler plant through underground mains. The pipes are laid in a solid log bored 2 inches larger than the pipe. The thickness of the wood remaining is 4 inches. The logs were painted on the outside with coal tar and sawdust. There is in the system 150 feet 10 inch pipe and 2,050 feet of 6-inch pipe, having a total heating surface of 5,605 square feet. The temperature difference was 235°. Twenty-seven horse power of return steam was required to supply condensation, *i. e.*, 1-horse power loss for each 820 feet of 6-inch pipe, or its equivalent surface, 1-horse power being taken as 30 pounds steam at 70 pounds pressure with feed-water at 100°. In a more technical form the heat loss is .614 B.T.U. per square feet for each degree difference in temperature. With what is considered good practice at the present time the radiator losses can be reduced to 40 per cent. of these figures.

There is no hard and fast rule for the proportioning of radiating surface. Of two buildings of the same construction apparently, one will be warm and the other cold. The formulæ given in text books are quite complex and involve considerable labor. The method used by a firm in the West which gave good results with a minimum of work, is as follows: The glass surface was figured, first taking total opening of window frame to allow for leakage. The exposed walls were figured and reduced to equivalent window surface. For unfurred brick or stone walls 15 inches thick 4 square feet was taken as the equivalent of 1 square feet of glass. For ordinary wooden dwellings and furred brick walls the ratio was 1 to 6. Extra warm construction was 1 to 8. For northern Illinois the required heating surface was 1 square foot for 2 square foot of glass. Rooms exposed to northwest winds the radiator surface was increased 10 to 15 per cent. Any unusual conditions were allowed for as experience suggested. Radiator was proportioned to maintain 70° inside with 0° weather outside.

The rates and methods of charging for central station heating vary considerably. There is a tendency to charge according to the space to be warmed rather than by square foot of radiation. For a store 20×80×14 the charge for heating is about $60. The radiating surface required is in the neighborhood of 250 square feet, or 25 cents per square foot heating surface per year. Such a store will use 5 to 7 tons of hard coal in an ordinary winter. At $7.50 per ton it will cost $45 to $50 per year for heating.

You are selling heat practically in competition with hard coal, and the rates you are able to secure will be based on that method of heating. In the territory covered by this Association you ought to get from 10 per cent. to 20 per cent. more than the cost with hard coal. You can offer a much better manner of heating, but with the disadvantage of the cost of the radiators and piping. The following are some examples of rates:

Plant 1.—Storeroom, 20 × 90-100, $60 to $70; office, 15 × 20, $20 to $25; bank, 20 × 30, $40 to $50.

Plant 2.—Store, 22 × 60, $50; 22 × 75, $62.50.

Plant 3.—$15 per 100 feet per year, or $2 per 1,000 cubic feet in brick stores; $3.50 per 1,000 cubic feet in dwellings.

Plant 4.—$100 to $125 for 10-room house.

Plant 5.—$0.25 per square foot per year.

Plant 6.—$3.50 per 1,000 cubic feet; heating done by live steam on meter.

As yet there is no meter on the market except that of the American District Steam Company, which is used only on their plants.

The cost of operation, outside of interest and depreciation charges, will naturally vary greatly in different plants. It should be borne in mind that your profit lies in selling exhaust steam rather than live steam. An increase in business beyond a certain point may not pay if fuel is high and the heating rates are low.

One foot of radiating surface will condense ¼ pound of steam per hour. Assuming that 5½ months' steady heating will be the equivalent work for one season, coal at $2 per ton of an evaporation power of 7 pounds, the fuel cost will be 19 cents. If the revenue from 1 foot will be 25 cents, it will probably be found that business does not yield any profit. In the stations of towns of less than 15,000 inhabitants, 75 per cent. of the maximum evening load will be carried for 5 hours during the heating season. Outside of these hourse the load will run about 30 per cent. for the remainder of the lighting hours. The day power load, if any, will hardly exceed the all-night load. The conditions will be that on the first floor 50 per cent. of heating business can be done with exhaust steam for at least 14 hours per day. The fuel cost of live steam furnished will be 11 cents per square foot. Another 45 per cent. can be supplied with exhaust steam 5 hours per day at a fuel cost of 15 cents per season. This would indicate that the profitable heating is that which can be taken care of during the greater part of the evening load. Cost of fuel will determine in each case whether new business will pay on a live steam basis.

Some modifications of central station design will follow when steam heating is added. The boiler portion of the plant becomes of much greater importance. Wastes which otherwise would be small assume greater importance when the work done by the boilers is more than doubled. Every effort should be made to bring them up to the highest efficiency. The installation of anxiliary devices as "Green's Economizer" will sometimes be advisable.

The use of storage batteries in connection with a heating plant

assumes a new importance. It can safely be assumed that during the hump of the load more steam will be used by the engines than can be discharged into the heating system. A storage battery can be used, to take a portion of the load during the time. Later in the night when the heating must be done in part with live steam it can be charged at a very small expense for fuel. Assuming boiler pressure 100 pounds, and temperature of water from heating system at 180°, 1 pound of steam entering the engine becomes .9 pound at exhaust by adiabatic expansion, a loss of 10 per cent. The steam at atmospheric pressure and weight for weight as compared with steam at boiler pressure contains 4 per cent. less heat. There will be available then 86 per cent. of the heat entering the engine. Engine friction and the loss by external condensation remain practically constant. Internal cylinder condensation is slightly less with the added load. Approximately the battery can be charged with 15 per cent. of the fuel required under ordinary conditions. When conditions are suitable there will be a marked gain by their use.

In alternating plants it will be necessary to provide a direct current load during the heavy lighting hours if batteries are put to this use. A power load would probably be quite small after 6 P.M. Long burning arc lamps could be installed very successfully in this connection. In this case a good construction would be made with a 220-volt power current and a three wire system for the arc lamps. Close regulation not being necessary, considerable complication due to cells and boosters could be avoided.

The generator might in some cases be used as a motor during the heavy lighting load, in the absence of an arc light or power load for the batteries.

To offset these advantages is the high cost of the battery and unwillingness of the smaller stations to make large increase in their investment for the sake of economical operation.

Once a heating system is in operation, it becomes a much easier matter to secure paying power or day lighting load. During the heating season the machinery can be run at a small additional expense; the principal items will be oil and the increased wear and tear. With the coming of the warm months a respectable fan motor business can be worked up, which will tide over the summer months when the station must be run daytime for power alone.

The Electric Meters of To-day.

[An abstract of a paper, before the Northwestern Electrical Association, by MR. R. F. SCHUCHARDT.]

Mr. George H. Jones, of Fond du Lac, and myself, have just completed a thesis, on American electricity meters, under Prof. D. C. Jackson, at the University of Wisconsin. The meters tested were the Thomson, Duncan, Shallenberger and Schaeffer.

The results obtained in our investigations show that the meters of the present day are not all that might be desired, and central station men, who know that the bills of customers using approximately equal amounts of light often vary to a great extent, and who continually have complaints of overcharges made to their companies, will bear me out in this. It is of the utmost importance that central station men test each meter they install. Many managers are beginning to realize the importance of this subject, and have added meter testing departments to their stations, where all meters are tested before they are installed. After they are once installed they should be inspected every six months or so, in order to see that they are working properly. This is hardly ever done at present.

The curves of the tests illustrate very clearly the action of these meters. Our method of calculating the error of the meter may be of interest. The speed of the meter is directly proportional to the load; therefore, for a given load the product of seconds per revolution of the armature and amperes (in ampere-hour meters), or watts (for watt-hour meters), equals a constant (which we call K), which varies with the make and size of meter. As will be seen this K is the time in seconds which it takes for the armature to make one complete revolution per unit of load (ampere or watt).

The product of the observed load and seconds per revolution, divided by this K, $\frac{\text{amp. x sec.}}{K}$, or, $\frac{\text{watts x sec.}}{K}$, should then equal unity for an accurate meter and the variation from unity will give directly the error. Should this quotient be more than unity, the meter runs too slowly on that load; and if less than unity, the error will be negative, which means that the meter is running too fast.

Thus, let the time per revolution be four seconds for a load of 440 watts on a 10-ampere, 100-volt Thomson wattmeter. The value of K for this meter is 1,800; then, $\frac{4 \times 440}{1{,}800} = .973$, which shows that the meter runs 2.2 per cent. too fast on that load. Or, let the time per revolution of the armature be two seconds for 3.3 amperes on a 20-ampere Shallenberger ampere-hour meter in which the value of K is 6.33; then $\frac{2 \times 3.3}{6.33}$. The meter is, therefore, 4.2 per cent. slow on that load.

The curves show that the action of the meters is very irregular, but their general behavior is clearly shown.

We found our samples of the Duncan watt hour meters to run too fast, but by properly adjusting the magnets, their error could be brought within the limits of about 5 per cent. either side. Both of the Duncan ampere-hour meters tested started much too slowly, and were also much too slow on the high loads. The effect of frequency is very marked, the difference in error at full load between frequencies of 60 and 130 being about 30 per cent.

After starting load, the Schaeffer wattmeter ran with a small and fairly uniform error. These meters are designed for frequencies, and when built for two frequencies are provided with a special German silver resistance in the pressure circuit to compensate for the difference. One of the meters tested by us, built for frequencies of 60 and 130, ran with an average difference of about 6 per cent. between these frequencies.

All of the new Thomson wattmeters started on no load, while the old ones started much too slowly. Their curve of error is a remarkably straight line after starting load. They are, of course, independent of frequency.

The Shallenberger ampere-hour meters started much too slowly. One of the three tested ran fairly uniform after starting, while the other two were too slow on high loads. The higher frequency makes them run from 5 to 15 per cent. faster.

The Shallenberger watt-hour meter was found to be very fair. It started on a very light load, ran without any great error, and responded promptly to changes of load. Frequency had no appreciable effect.

All of the meters tested are practically unaffected by the changes of pressure likely to occur in service. The Diamond wattmeter should not be used with inductive load, as the effect of such load is very marked, making the meter run much too slowly, and with a power factor low enough it stops entirely and even runs backward.

Besides these meters tested in the laboratory, we were enabled, through the courtesy of the Madison (Wis.) Gas and Electric Company, to test meters in actual service. The general results of this test indicate that the ampere-hour meters require a comparatively large current to start them; run much too slowly on starting load and on the higher loads. Most all of them have considerable error on overloads. The wattmeters are somewhat better, and as a rule run too fast on all loads except at starting and with a fairly uniform error. The Thomson meters show the least variation in error, but the continuous watts absorbed are more than in any of the others.

A fact of great importance brought out in this test is the lack of proper attention paid to the installation of the meter. In many cases the meters are placed on door frames where they are continually jarred. They should be installed by securely fastening them to a firm wall in a readily accessible dry place and well leveled. The meters should all be carefully sealed to prevent being tampered with. The seal should bear the private mark of the company, so any unauthorized inspection of the meter can be detected. The meter is a delicate piece of apparatus and should be carefully handled when being placed in position so as not to injure it.

After it is installed, it should be tested to be sure it is running correctly. Spiders and insects in general are very fond of the warm meters, and have many times helped to reduce the consumer's bill. The meter should, therefore, be dust proof and be regularly inspected.

Paint Tests.

[From a paper read by MR. MAX TOLTZ, before the Society of Civil Engineers, St. Paul, Minn. Reprinted from the "Journal of the Association of Engineering Societies."]

This paper records the result of considerable thought, study and time, which have been given to the above subject during the last three years in making careful laboratory examinations of the various paints sold in the market as "anti-rust," and under other names, and in practical experiments.

The compilation of the work thus far done is given in a condensed form only; therefore, the usual style of reporting is reversed, and the

recommendations and conclusions arrived at are given at the beginning. From our present knowledge, the following system for painting iron and steel bridges and other metallic structures is recommended :

1. Give the iron and steel a coat of the best grade of refined linseed oil, properly boiled and settled clear; or, still better, mix linseed oil with about 10 per cent. of a good grade of lampblack ; this coat to be applied at the mills, the iron or steel being first carefully cleaned from loose scales.

2. After the structures have been erected, give them one coat of real asphaltic varnish paint, made from the best grade of asphalt, linseed oil and gum, compounded properly, so as to form a true varnish ; or of a paint made from carbon black and a properly boiled varnish, compounded of the best grade of linseed oil and gum. This coat should be carefully applied by a skillful painter, after the metal has been thoroughly cleaned from all loose scale, rust, shavings, filings, shriveled oil or paint, grease, dirt, or any foreign matter, because it is of the utmost importance that the paint should be spread and worked in such a way so as to cover the surface properly, and be as free as possible from air bubbles and form a continuous coating. This priming or first coat should be applied fairly thick, the thickness depending, to some extent, on the nature of the paint used. Before the second coat is applied, the first one should be thoroughly dried and hardened by natural oxidation, which will require at least 10 days. If practicable, it would be a great deal better, as well as more economical, to apply the second coat not less than four weeks after the first one.

3. As a second coat, a good grade of graphite paint is to be applied as thickly as possible, working the paint thoroughly with the brush. From the examinations made of the various grades of graphite paints, as far as graphitic pigments are concerned, there appears to be but little difference between them, provided, of course, that the pigment contains at least 33 per cent. of pure graphite, the rest of the pigment being natural rock, ground very fine in pure linseed oil. The graphite paint should be bought in paste form, well ground, and contain not less than 70 per cent. of pigment and 30 per cent. by weight, of the best quality of boiled linseed oil ; the paste should be mixed with boiled linseed oil at the place where it is to be applied. No turpentine, no benzine, and no Japan or driers should, under any circumstances, be allowed in this paint.

The system just described, if properly carried out, will give a protective coating which will last for many years, and it is firmly believed that this system of painting (provided that the paints are of the best quality) will protect iron and steel for a longer period than any other system now in vogue.

4. There are certain parts of steel or iron bridges, viaducts or tunnels that should have an additional (third) coat of paint. These include such places, or parts of structures, as are directly exposed to the steam, fumes and gases from passing engines. For such a coat some cheaper asphalt paints, applied very thickly over the coats above recommended, would be all-sufficient. Such a coat would protect the underlying primary coats for many years, preserving their natural toughness and elasticity, and preventing atmospheric action on the structure.

In the past, red lead was largely, if not exclusively, used as a paint for iron and steel structures, but within the last ten years it has been to a great extent discarded by progressive engineers and builders. It is true that we to-day have advocates of red lead as the best paint. Still, the fact that these so called red lead men now begin to add carbon black or graphite to their paint, is a sure sign that they themselves no longer believe red lead to be the best pigment.

Fifteen years or more ago iron oxide men appeared and flooded the country with their various grades and qualities of iron oxide paint, as being the paint which nature itself had provided for the protection of steel and iron structures against rust and corrosion. From the investigations made, as well as from practical experiments, it appears that the iron oxide paints are not very desirable, at least for the first coat or two, for iron or steel ; but, as a third coat, for the protection of the underlying paints, they may be recommended.

However, the extensive investigation of the graphite paints that can be obtained in the markets to-day shows that, if properly applied, they are far superior to iron oxide paints for the second or third coat, especially as they withstand the action of moisture and water much better than the best iron oxide paint so far examined. Besides, a graphite paint, in paste form, well ground and mixed with boiled linseed oil, will not cost very much more per gallon than the cheapest iron oxide paint in the market.

In recommending asphalt varnish paint or carbon paint for the first coat, great stress is laid upon the necessity of having the surfaces of iron or steel as free from moisture as possible while the structures are being painted, otherwise there is great danger that the coating will not adhere very firmly, and that it will thus actually nullify the value of the paint. This precaution is less important when an ordinary iron oxide paint or red lead paint, simply mixed with linseed oil, is used ; because linseed oil itself has the property of absorbing moisture quite readily, whereas carbon or asphalt paint will not. The lack of this property in the two last-named paints is one of the principal reasons why they are superior to any other class of paints.

Although it is proper that true economy should always be exercised, preference should not be given to any paints whose properties lie simply in the fact that small quantities of them cover great areas. Often the first question asked is : "How many square feet can you cover with a gallon of your paint?" cheapness being considered the most important factor. Of course, the greater the number of feet that can be covered with one gallon of paint the thinner will be the protecting coat. There is a limit beyond which it is inadvisable to carry this. Other things being equal, the paint that can be spread over a fairly good area should be considered superior to any which goes to the extreme either way.

The various paints examined are classified under the following heads :

1. True asphaltic varnish paints.
2. So-called asphaltic varnishes or paints, of inferior qualities.
3. Black carbon paints, in which the vehicle is practically a varnish.
4. Iron oxide paints, consisting of more or less iron oxide with more or less siliceous matter and compounds of lime or of magnesia.
5. Graphite paints and silica graphite paints.

The tests were carried on through periods ranging from six months to over two years. The number of paints subjected to test was 22. All these paints have been analyzed chemically to ascertain the quality of material used in them.

The true asphaltic varnish paints are compounded in the same manner as the black japans, known as baking japans, and are made practically in the same way as varnishes, from linseed oil, gum, asphaltum and turpentine. Some of them contain carbon black and a small amount of inert mineral matter.

The carbon paints consist, as regards the pigment, mostly of carbon black, with some white lead; the vehicle in which the paint is ground is practically a linseed oil varnish, thinned down with turpentine. These two paints are closely related to one another and are comparable. Both are considered to be of great value for the protection of iron and steel, if properly applied.

The asphalt paints of inferior quality, which might be of value as a last coat, or wearing coat, especially on certain parts of bridges, viaducts or tunnels, are made of asphaltum dissolved in benzine or other volatile oils, but are not a true varnish made from linseed oil. They contain about 43 per cent. of volatile oils and 56.5 per cent. of solid carbonaceous bitumen (asphaltum).

In using these paints, namely, asphalt dissolved in benzine, in mixtures of benzine or rosin spirit, or in other light neutral oils, the principal trouble is that in spreading them over oiled surfaces the light oil evaporates so fast that it is difficult to spread them properly. There is also another objectionable feature in connection with the benzine paint, namely, that where such a paint is applied to iron surfaces the rapid evaporation of the benzine absorbs a great deal of heat, and, if the air should happen to be highly saturated with moisture at the time, the reduction in the temperature of the surface of the adjacent iron may cause a condensation of moisture, preventing the paint from coming in close contact with the iron and producing a tendency to blister.

These cheap asphaltic paints may show up well enough in the beginning, but as a rule, after the volatile oil has evaporated, especially in subjecting the painted iron to the heat test, the coats become quite brittle, can be easily removed by abrasion and do not protect the iron against rust.

As a matter of interest, it may be here stated that one of the so-called asphaltic paints when analyzed chemically showed no asphaltum at all.

The iron oxide paints were of different grades and qualities. It is not the intention of the writer to give their chemical analysis, because every paint was compounded differently and contained more or less iron oxide and siliceous matter. As a rule the paints were well ground, and spread and covered to a satisfactory extent.

As stated before, the graphite paints contain from 33 to 83 per cent. graphite, the balance being inert insoluble matter, consisting mostly of compounds of lime, magnesia, alumina and iron oxide.

Besides the chemical examination, the paints were subjected to a systematic practical test, to ascertain their real values as anti-rust paints.

For that purpose comparative tests, by painting pieces of sheet iron, tinned iron and galvanized iron, wooden boards and shallow sheet iron dishes were carried on.

The iron dishes were about 12 inches in diameter and about ½ inch deep, having a capacity of about ½ pint. The scale or skin was carefully removed before painting, so as to have a clean surface of iron exposed next to the paint. Two dishes were painted with each kind of paint—one of them receiving one coat, the other two coats, the first coat having dried thoroughly (for at least a week) before the second coat was applied. After the second coat had completely dried and hardened these dishes were exposed to the so-called water and moisture test, in which a given amount of water is placed in the dishes and allowed to evaporate to dryness at the ordinary temperature of the room. This is repeated a number of times, until the inside of the dishes begins to show more or less rust. All dishes were carefully examined before each refilling. After most of the water has evaporated, there remains, at the junction around the edge, a thin film of water, which in contact with the air and with the carbonic and other acids in the air, acts on the paint in such a way that the iron under the paint begins to rust. The rust thus formed develops more and more after each evaporation, in some cases practically covering the whole dish in a short period. In actual practice and service the same thing will happen, the only difference being that the rust will extend under the paint and will not show as plainly as on the dish. This test is a most important and severe one for the purpose of determining in a relatively short time the weather-resisting power of a paint. If the paint is unable to resist this action of the water or moisture under these conditions, it cannot be desirable for the protection of iron or steel structures. But other qualities in the paint have to be taken into consideration in connection with this test before a correct opinion as to its merits can be formed.

The dishes painted with true asphalt varnish and with the carbon were refilled 14 times. The dishes painted with one coat showed very little deterioration, while the dishes with two coats showed none at all, the paint being as elastic and tough as when first applied.

The behavior of the cheap and inferior so-called asphalt paints, applied on the surfaces of the dishes, was quite different. After the fifth exposure, the dishes with one coat showed considerable rust all over. Those with two coats, after the seventh exposure, showed not much better.

Quite a difference was apparent in the test of the iron oxide paints On the average, after the fifth exposure, a good many rust spots or specks appeared on the surfaces of the dishes painted with one coat. The dishes with two coats were refilled six times and on them rust could be easily detected with the naked eye.

The graphite paints so far examined acted much the same in comparison with one another; although, upon chemical examination of the samples submitted, quite a variation was found in the amount of graphite present in the pigment.

The object of procuring the graphite in the form of paste was, in the first place, to get the paints ground only in boiled oil, so that they could be thinned with oil before painting, under exactly the same conditions; second, if, after the examination and tests, any difference was found, it would be easy to ascertain whether or not such difference was due to the amount of graphite present. In mixing these different graphite paints with boiled linseed oil, ready to apply, 4½ parts of paint and 3½ parts of oil, by weight, were used. As all these graphite paints were received at about the same time, all the comparative tests were made under exactly the same conditions, and all moisture or water tests were made side by side. Therefore, the results obtained so far are comparative and consequently of more value than otherwise would have been the case. All the dishes with one coat were exposed 10 times to the water test, and on examining the records it will be observed that all these graphite paints began to show a few specks of rust after the fifth evaporation, and that the number gradually increased after each successive evaporation. After the tenth exposure some slight difference between them is shown, but not very much. All the dishes given two coats have so far been exposed 13 times, and none of them shows any rust or indication of rust. The natural toughness and elasticity are still in the paint after the treatment.

Besides this moisture and water test, all paints have been subjected to a heat test, by placing painted sheet iron in the core oven of the brass foundry of the Great Northern Railroad shops. The temperature of this oven varies from 220° to 300° F., and, as the fire is a direct one, all the gases of combustion, such as carbonic acid, sulphurous acid and watery vapor, came in direct contact with the painted iron. This test is of value also as showing promptly whether a paint will keep its elasticity or will become brittle so that it may be easily removed from the surface. In several instances this test brought out serious defects in some of the paints examined, which had shown fairly good results in the other tests. This was the case especially with the cheaper so-called asphalt paints.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. JAMES B. HARRIS, since 1883 Secretary of the Terre Haute (Ind.) Gas Light Company, resigned that position on the 1st inst. His successor is Mr. John A. McArthur, formerly of the Terre Haute Lime and Coal Company. Mr. Harris will remain in Terre Haute.

MR. ISAAC BATTIN, the Superintendent of the Omaha (Neb.) Gas Company, is arranging for the placing of the main system that is to supply gas in the South Omaha district. Some Southern pipe foundry secured the contract for the pipe.

WE understand that the proprietors of the Emporia (Kas.) Electric and Gas Company have sold their electric lighting annex to the city, for operation by the authorities on municipal account. It is further said that the price agreed upon was $17,000.

THE United Gas Improvement Company has been authorized to install one of its standard, double superheater water gas sets in the works of the Richmond (Ind.) Light, Heat and Power Company. The capacity of the new apparatus is estimated at 400,000 cubic feet per day.

THE Howard-Harrison Iron Company, of Bessemer, Ala., has been awarded the contract for furnishing 1,500 tons of pipe for the extension of its water main system by the Macon (Ga.) Gas Light and Water Company.

THE Berlin Iron Bridge Company, of East Berlin, Conn., will erect the new boiler house which the New York Belting and Packing Company purposes to erect at Passaic, N. J. The building will be entirely fireproof, with steel roof trusses, the same to be clad with the Bridge Company's patent anti-condensation corrugated iron covering.

WE are indebted to a correspondent for the following particulars relative to the retirement of Mr. J. O. Starks from the dual position of Secretary and Treasurer to the St. Joseph (Mo.) Gas and Manufacturing Company, a position which he filled for several years most acceptably:

"Mr. J. O. Starks, on his retiring from the service of the St. Joseph Gas and Manufacturing Company, as its Secretary and Treasurer, was presented with a gold watch chain by the office employees. On the afternoon of the presentation Mr. Starks was somewhat astonished when his office associates gathered at his desk. General Manager K. M. Mitchell headed the group, and, without affording Mr. Starks an opportunity for questioning, presented him the handsome gold token named above, accompanying the presentation with the following words: 'Mr. Starks, you are no doubt surprised at this gathering, and will wonder what it all means. Your associates in the St. Joseph Gas and Manufacturing Company have taken this occasion to show in a measure their affection for you and their appreciation of the many kindnesses you have shown them. You are about to retire from the position of Secretary and Treasurer of the St. Joseph Gas and Mannfacturing Company (the Company having sold its interests to another Company), a position you have filled so acceptably. We, the employees of the St. Joseph Gas and Manufacturing Company, have always found in you a true friend. You have always been helpful and encouraging. In our eight years of service together we do not recall a hasty or unkind word spoken. We hold you in great esteem, and now, in behalf of the employees of the old Company, allow us to hope that the chain we offer you will in some measure bind us in the future as the ties of our old relations bound us. That you may live many years to twirl it is the best wish of your many old friends of the St. Joseph Gas and Manufacturing Company.' Mr. Starks' response was short but heartfelt, the retiring officer doing the best he could to repress the emotion that moved him."

UNDER the policy of the succeeding Company, Mr. F. Labrunerie, of the St. Joseph Light and Fuel Company, was named to replace Mr. Starks in the position of Secretary and Treasurer, and Mr. Kerr Murray Mitchell was selected as Manager of the corporation.

THE management of the Portsmouth (Ohio) Gas and Electric Company have determined to pay less attention than heretofore to the elec-

tric division of their business. It seems they are agreed that the gas end of their trade makes by far the better return on the money invested.

A CORRESPONDENT forwards the following clipping from a Milwaukee (Wis.) newspaper: "The Milwaukee Gas Light Company is contemplating the erection next year of an addition to its plant, which will entail an expenditure of $250,000, and form the nucleus of a new plant which will put the Company in position to supply any service of gas that might be required in a city of 1,000,000 people. The Company has acquired considerable property in the Menominee Valley, at the foot of Twenty-first street, and it is there that the new plant will be located. The work to be performed next year, if the plans do not miscarry, will be the erection of a large gasholder, which will be used to supply the west side. From a casual view there does not seem to be much to gasholders, as the uninitiated look upon them; but there is enough, however, General Manager Cowdery says, to make the cost foot up to $250,000 for such a holder as the Company intends to build. The gas that is to be stored in the new holder will be manufactured in the Third Ward plant, and the work of laying the large main to convey the gas to the holder is underway. This main, which is of 24-inch diameter, has been laid as far as Tenth street and St. Paul avenue, and it is the purpose of the Company to extend the main to Eighteenth street, on St. Paul avenue, this year, to use it as a feeder for the west side during the winter. Ultimately, the Company will build an extensive plant around the holder in the valley, which will then be the center of the Company's manufacturing establishment."

THE majority of the reputable business men of San Leandro, Cal., are outspoken in their advocacy of the Welsbach street lamp for the illumination of San Leandro's streets.

MR. JOHN H. SHACKLEFORD, representing the New York Security and Trust Company, made application recently, before Judge G. H. Hanford, of the Federal Court for the district of Seattle, Wash., for the appointment of a receiver for the Tacoma (Wash.) Gas and Electric Company. The bill of application recited that the Company is indebted to the Trust Company as trustee under a mortgage for $500,000, and $12,000 interest on the principal note.

TWELVE merchants of Palo Alto, Cal., united in forwarding the following "hint" to Manager Fish, of the Peninsular Lighting Company, of Palo Alto. The "hint," although not modelled in accordance with the acknowledged best system of English, is very much to the point: "Mr. Fish—We, the undersigned patrons and consumers of your electric light in Palo Alto do hereby protest against the light you are furnishing. Therefore, we have resolved that, unless you will furnish light as agreed, we will sever our connections with your firm by taking out the lights and putting back our lamps immediately. We find by official test that we are getting about 8-candle power to each lamp, until after 9 P.M., and as most of our stores are closed at that time we are not getting what we are paying for. We are paying for 16-candle power, and insist on getting what is due us, or we will do without."

MESSRS. J. H. Becker, S. S. Richards, W. C. Turry, H. V. Becker and B. A. Becker have incorporated the Clyde Gas Company, of Clyde, Sandusky county, Ohio, They purpose to manufacture and distribute illuminating gas in the place named. The capital stock is $30,000.

THE proprietors of the Visalia (Cal.) Gas, Light and Heat Company propose to keep up the supply of electric current during the 24 hours. They might "better let bad enough alone."

THE acetylene promoters are showing their goods in Bridgeton, N. J. Bridgeton looks a poor place for such display, since the Bridgeton Gas Light Company, under Superintendent Harding's clever management, is selling a very satisfactory article of coal gas at a price perfectly satisfactory to the residents of the Glass City.

THE new rate at Bristol and Warren, R. I., by the Bristol Gas and Electric Company, of $2 per 1,000 cubic feet, with 5 per cent. off for prompt payment, is now in effect.

THE prepayment meter is finding much favor in Terre Haute, Ind. Superintendent Diall favors the idea of placing the prepayments for customers of the transient class, rather than furnishing them with regular meters and requiring a deposit thereon.

IT is not altogether an impossibility that the American Gas Company will in the end secure control of the Louisville (Ky.) Gas Company. It is amusing at this distance, and at this time, to consider the queer weakness displayed by certain Hebraic interests in the Company's ownership.

MANAGER SHORES, of the Kankakee (Ills.) gas works, has completed a well-planned system of improvement on that plant, especially in the instance of the generating capacity. It is the boast of the Manager that 80 per cent. of those using gas for illuminating purposes also use it for cooking or heating.

THE "proprietors" of the Bay State Gas Company, of Wilmington, Del., have again applied to the Street and Sewer Department for the right to lay gas mains in Wilmington. Meantime it is thought by many that Mr. Betts and his associates could do worse than to buy for cash any fair property that the Bay State Gas Company, of Wilmington, owns. 'Tis the only safe way to lay the ghost.

THE Louisville (Ky.) *Courier-Journal*, of the 12th inst., says that Chairman Sneed, of the committee appointed by the stockholders of the Louisville Gas Company, to dispose of the control in its stock, has declared that the assent of the holders of about 19,000 shares is pledged. This is well over 900 shares more than enough to secure the end in view—plus necessary legislation.

Coal Mining in Michigan.

Iron Ore says that Michigan, while it has coal mines, is not a large producer of this mineral. The trouble has been that the seams are too thin to permit of a product that would permit of competition with other States where better natural advantages for ready and cheap production are had. Many attempts have been made at different sections throughout the central and southern portions of the State to secure coal in greater quantity than heretofore found, but little improvement over the old seams has been made. The coal veins of Michigan run from 2 to 4 feet in thickness, and the strata is found at a depth from surface of from 125 to 150 feet. Where worked, the coal is generally disposed of to railroads running close to the mines, and is also retailed to those who live in the immediate neighborhood. Much of the coal is of excellent quality, a little being suitable for coking. The price secured for the product at the mines is about $1.35 per ton, this being paid by the railways, which are the heaviest consumers. In a retail way about $2 per ton is secured. The wages paid the miners run from $1 to $1.50 per day, much of the labor being performed by farmers who live near the mines, and who have a certain amount of time they can spare for such work.

At Bay City two new mines have been opened, these being the properties of the Bay Mining Company and the Montour Coal Company. The mines are located five miles from Bay City, and the product has been carried to town by teams, an expensive method. The companies are talking of securing a spur track from the mines to Salzburg to connect with the Michigan Central and Grand Trunk Railways.

The Montour's product for 1896 was 8,000 tons, it working but eight months of the year. It has one shaft 140 feet deep to the coal seam, which latter is 3½ feet thick. Forty men are being employed. They talk of putting down a second shaft and equipping it with a modern plant of machinery. It has doubled its capital stock, having this object in view. They believe they have a mine that will warrant the expenditure proposed.

The Bay Mining Company has been working but a short time, only two months during 1896, it being a new concern. It has been employing 27 men getting a shaft down and opening up the seam, The shaft is 140 feet deep and the coal seam is 3½ feet thick. They expect to mine, as soon as they get in shape, 400 tons per day. They lack railway facilities as yet.

The Sebewaing Coal Company is the largest producer, its product for 1896 amounting to 27,996 tons, the mine being worked about half time, the force of men employed when the property was working consisting of 65. They have one shaft to the coal seam, it being 125 feet from the surface. The seam here is thicker than at any other properties, 4½ to 5 feet. No improvements in the way of machinery were made during the year.

The Corruna Coal Company produced 14,221 tons of coal during the year. The total product for the year of the mines wrought amounts to 50,953 tons as against 50,764 mined in 1895.

At Williamstown, Mich., some work was done during the year in exploring for coal in that vicinity. A seam 30 inches thick was found 18 feet from the surface, and a second seam larger than this was encountered at 45 feet, slate forming the hanging of both seams. An effort will be made to develop the property during 1897.

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PROPRIETORS.

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MONDAY, SEPTEMBER 20, 1897.

Power Transmission at Milwaukee Dry Dock Plant.

An interesting application of rope transmission of power is noted in a recent issue of *Power and Transmission*. The Milwaukee-Rice Machinery Company equipped the Milwaukee Dry Dock Company's plant, at Milwaukee, Wis., with an outfit of the Dodge patent American system. Power is transmitted by means of a single 1-inch rope more than 200 feet from a 100-horse power engine in the blacksmith shop to the saw mill. These plants stand at an angle of 45°. The engine wheel is 96 inches in diameter, has 8 grooves, and transmits power to a sheave with a diameter of 6 feet and grooved for 10 wraps of the rope. Two of these grooves are used to drive an auxiliary shaft. One continuous rope transmits power direct to the shaft in the saw mill. This is accomplished by an arrangement of idlers over the main line shaft in the blacksmith shop, no idler sheaves being used in the saw mill except the winding sheave, which is placed beside the driving sheave, running loose on the shaft so that any slippage (due to differential tension of the rope driven the distance of over 200 feet) is compensated for without friction. Both the rope and the tension carriage are entirely exposed to the weather. This tension carriage, a feature of the American system of rope transmission, automatically takes up the slack rope occasioned by atmospheric changes, or other causes, and keeps up an almost uniform rope tension. The rope is rendered impervious to the weather by applications of AA-A1 rope dressing.

This transmission has been in daily operation for nearly two years. Not a minute has been lost on account of any failure of the rope or any of the transmision saccessories. The drive travels at a high rate of speed, yet to one looking at the rope in operation it would at first sight appear to be perfectly quiet, so little vibration is noticeable.

The power in the plant was formerly transmitted by means of ropes, but by a different system, employing no tension carriage, and the longest life obtained for any rope was six months, while many played out in much less time, and all ropes required constant attention, being spliced and respliced many times ere being discarded.

The satisfactory working of this drive is further emphasized by the fact that the Milwaukee Dry Dock Company are adding a most extensive plant for the working and shaping of steel for the purpose of building and repairing steel vessels, and have adopted the American system of rope driving for transmitting power from the engine in this new shop to the main line shaft and also to an auxiliary drive to transmit power from the main line shaft to the minor line shaft on the opposite side of the room. Each of these shafts is over 100 feet long, is $3\frac{7}{16}$ inches in diameter, and fitted throughout with Dodge adjustable capillary self-oiling pillow blocks.

The Market for Gas Securities.

The market for city gas shares last week surprised even the veterans of the City Bank, who it may be taken for granted know to the last dollar the intrinsic worth of Consolidated gas. The net gain in Consolidated for the seven days amounts to 21 points, the selling price at noon to-day (Friday) being 240. The gains in all other city gas shares yet maintaining independence have been phenomenal. Messrs. Sage and Terry have surrendered—it might perhaps be putting it neater did we say they have agreed to a price for their holdings in Standard gas. The common of Standard is quoted at 167, bid, ex "rights," and Wall street is bidding 7 for the plain "rights." The advance in Standard has been out of all proportion to its merits, for if that concern were to remain in active trade its proprietors would have to expend at least $1,000,000 on plant, in order to even keep them in the "gas swim." Equitable eased off to 295 and Mutual is virtually at 400. It is cheap at that.

We will have to be excused for still sticking to Consolidated, which we think offers by far the greatest opportunity for profit to come (always excepting Mutual) in the readjustment of city gas share values. The promulgation of the general plan of reorganization cannot much longer be delayed. One token in connection with the beginning of the end is the voluntary retirement of General Jourdan from the New York and East River Company. Brooklyn Union sold up to 136 during the week, and is now 135 to 135½. An amusing feature in the Brooklyn situation is the peddling going on over control in the Flushing Company. Chicago gas is very strong, at 107⅜, and Baltimore Consolidated is also in demand, at 61½ to 62. Bay State developments are a trifle amusing, what with a promised issue of $10,000,000 new stock, more reported resignations of executive officers, and so on. Lacledes are steady; they are also high. Detroit gas is nominally 48 to 48½. Cincinnati gas is 203¼ to 203¾.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

SEPTEMBER 20.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	239	240
Central	500,000	50	195	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	294	298
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	395	410
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	85	
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	92	94
Preferred	2,000,000	100	116	118
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106⅛
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	167	168
Preferred	5,000,000	100	168	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	135	135¼
" " Bonds (5's)	15 000,000	1,000	113⅛	114
Bay State	15,000,000	50	11¾	12
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	93	..
2d " " "	3,000,000	1,000	80	81
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	107⅛	107⅝
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	90	91
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	75	..
" Bonds	600,000	1,000	101½	103
Cincinnati G. & C. Co.	8,500,000	100	203⅛	203¾
Consumers, Toronto	1,500,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	61½	62
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000		48	48¼
" Con. Bonds	4,312,000	..	92½	93½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	83	84
" Bonds	2,000,000	..	93	95
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	143	150
" Bonds, 6's	2,650,000	..	107	109
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	88	89
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	45	45¼
Preferred	2,500,000	100	94	95
Bonds	9,034,400	1,000	103	103½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	142	..
Bonds, 6's	4,000,000	.	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53⅛	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10,000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500,000	25	34¼	35
Bonds	1,000 000		98	100
Washington, D. C.	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	86¼	87¼
Bonds, 5's	3,556,000	.	98	100
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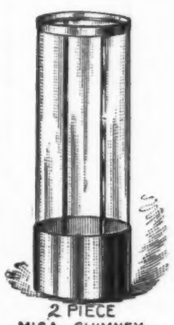

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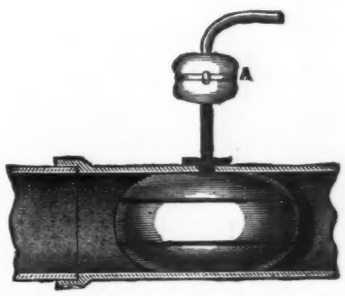

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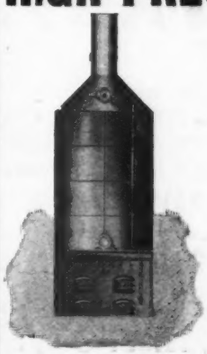

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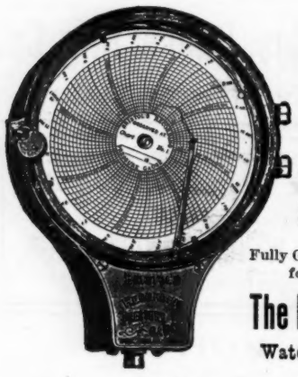

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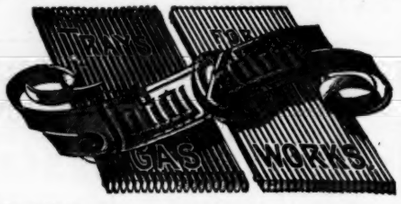

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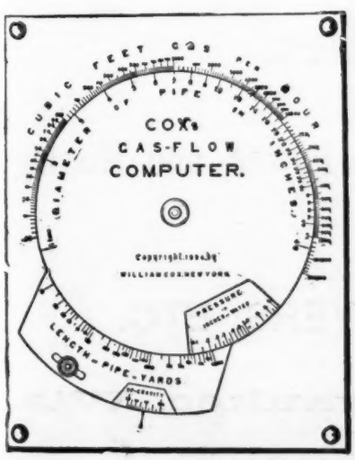

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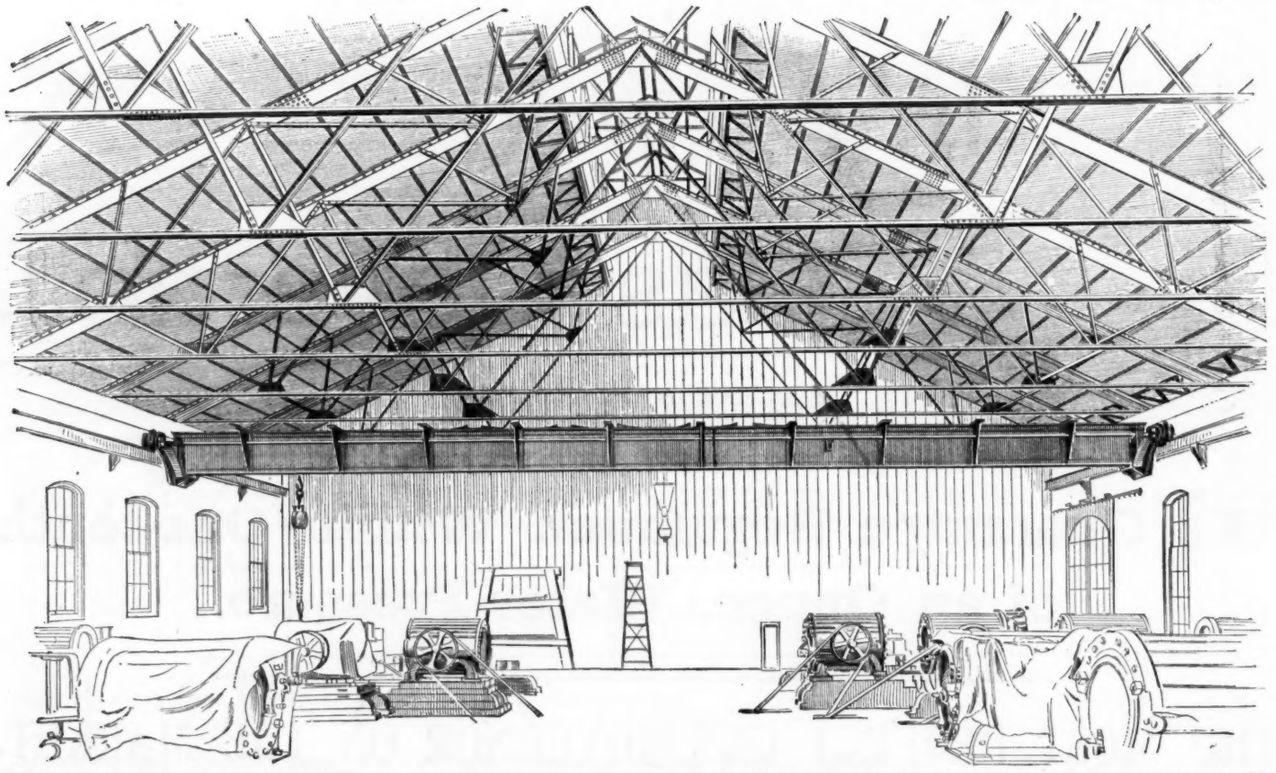

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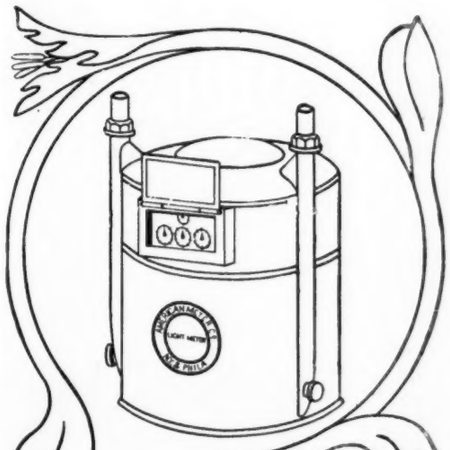

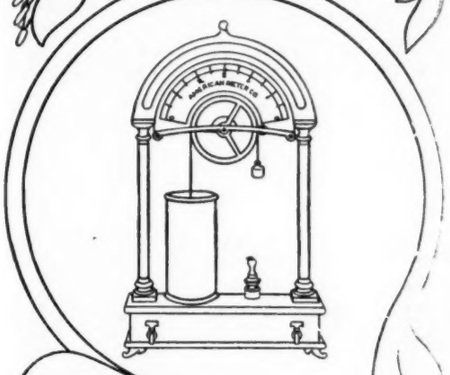

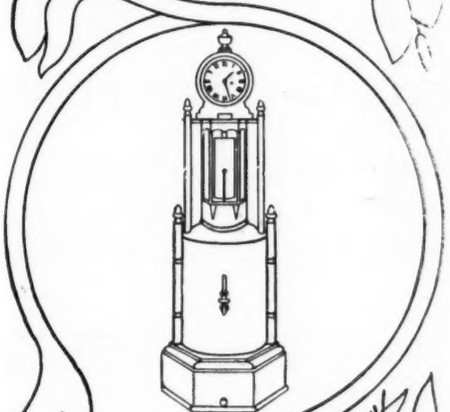

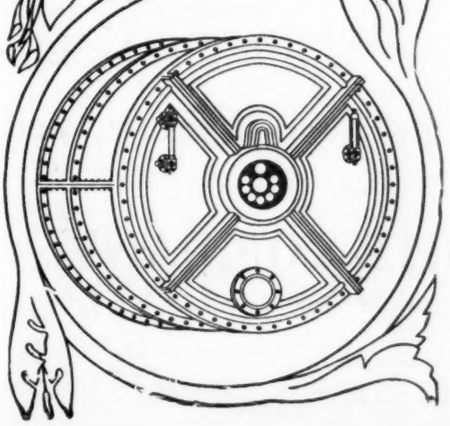

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NEW YORK AND PHILADELPHIA,

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SAN FRANCISCO.

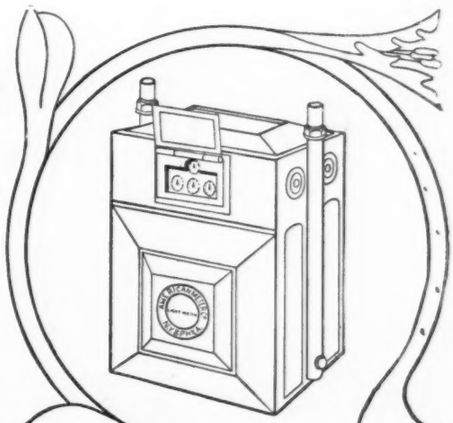
PUBLIC LIGHTING TABLE.

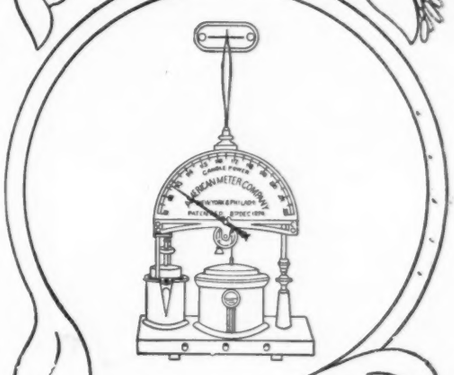
OCTOBER, 1897.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	8.10 PM	5.00 AM	5.30	5.00
Sat.	2	9.20 FQ	5.00	5.30	5.00
Sun.	3	10.30	5.00	5.30	5.00
Mon.	4	11.40	5.00	5.30	5.00
Tue.	5	12.50 AM	5.00	5.30	5.00
Wed.	6	1.50	5.00	5.30	5.00
Thu.	7	3.00	5.00	5.30	5.00
Fri.	8	4.00	5.00	5.20	5.10
Sat.	9	No L.	No L.	5.20	5.10
Sun.	10	No L. FM	No L.	5.20	5.10
Mon.	11	No L.	No L.	5.20	5.10
Tue.	12	5.50 PM	7.00 PM	5.20	5.10
Wed.	13	5.50	7.40	5.20	5.10
Thu.	14	5.50	8.20	5.20	5.10
Fri.	15	5.50	9.00	5.10	5.20
Sat.	16	5.50	10.00	5.10	5.20
Sun.	17	5.40	11.00	5.10	5.20
Mon.	18	5.40 LQ	12.00 AM	5.10	5.20
Tue.	19	5.40	1.00	5.10	5.20
Wed.	20	5.40	2.10	5.10	5.20
Thu.	21	5.40	3.20	5.10	5.20
Fri.	22	5.40	5.20	5.00	5.30
Sat.	23	5.40	5.20	5.00	5.30
Sun.	24	5.30	5.20	5.00	5.30
Mon.	25	5.30 NM	5.20	5.00	5.30
Tue.	26	5.30	5.20	5.00	5.30
Wed.	27	5.30	5.20	5.00	5.30
Thu.	28	5.30	5.20	5.00	5.30
Fri.	29	5.30	5.20	4.45	5.35
Sat.	30	8.20	5.20	4.45	5.35
Sun.	31	9.30	5.30	4.45	5.35

TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45





To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

We assure the public there is no decision of any Court, in England or elsewhere, that directly or indirectly warrants the statement or inference that the lamp sold by the Sunlight Incandescent Gas Lamp Company of America is not an infringement of the Welsbach Light as made under the American patents, of which the Welsbach Light Company is sole and exclusive owner.

NOTICE is hereby given to all PURCHASERS and USERS of the so-called "Sunlight" lamp that suits will be brought against them for DAMAGES for INFRINGEMENT of the Letters Patent of the Welsbach Light Company, and will be prosecuted vigorously.

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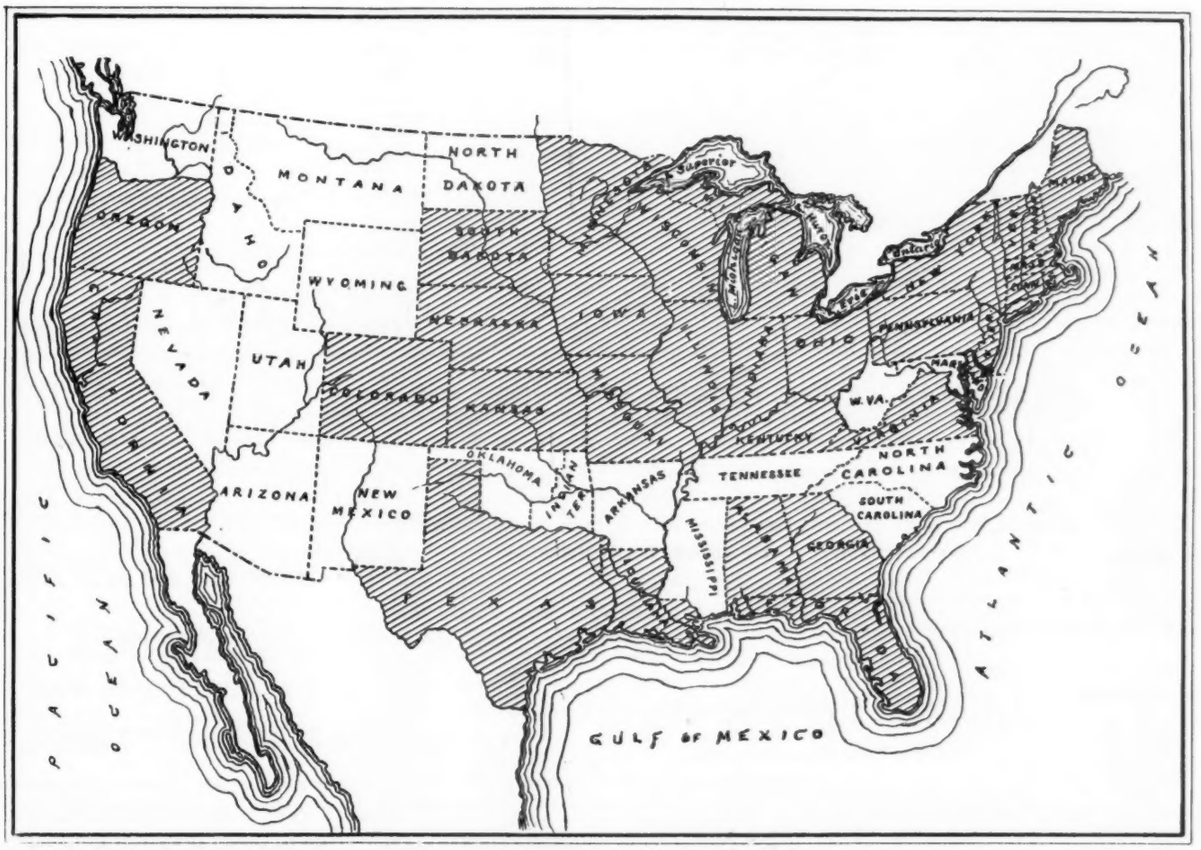

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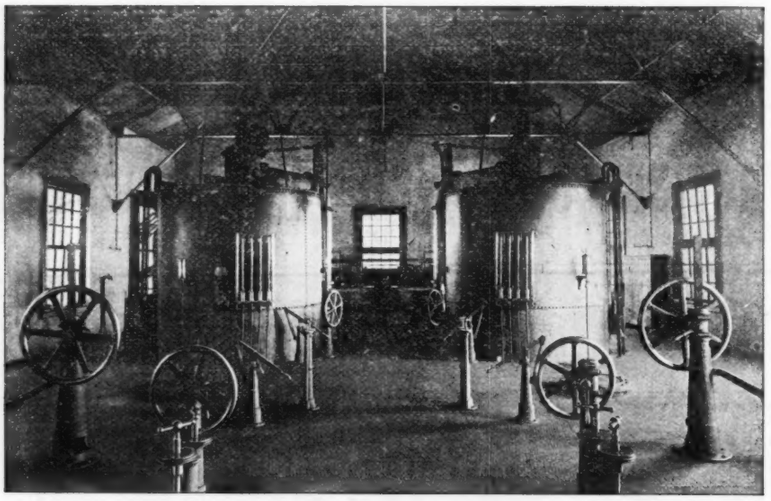

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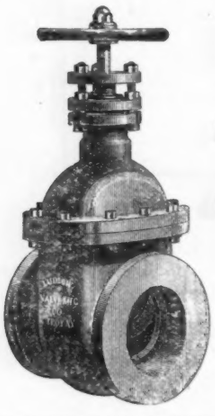

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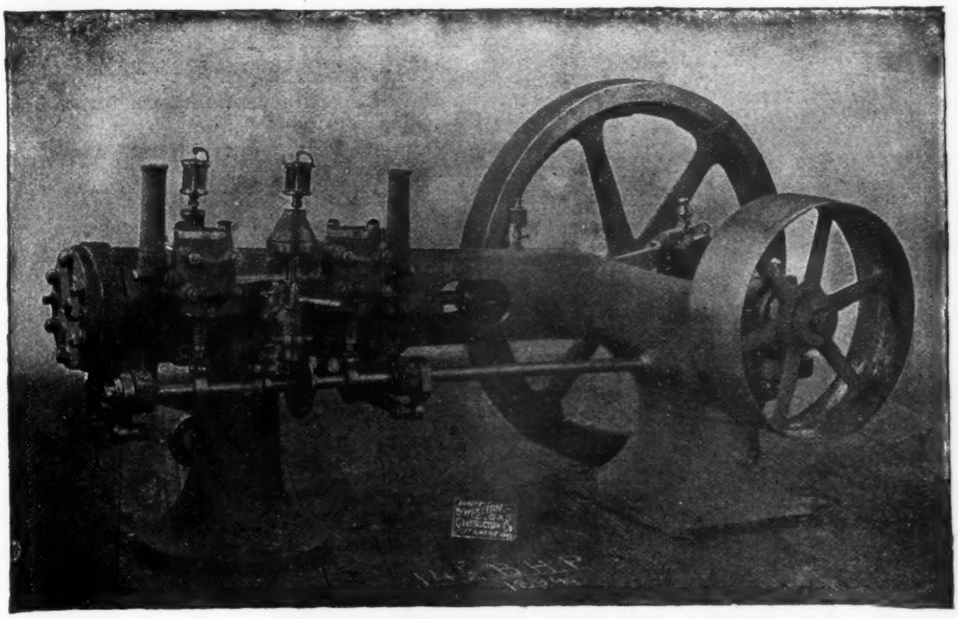

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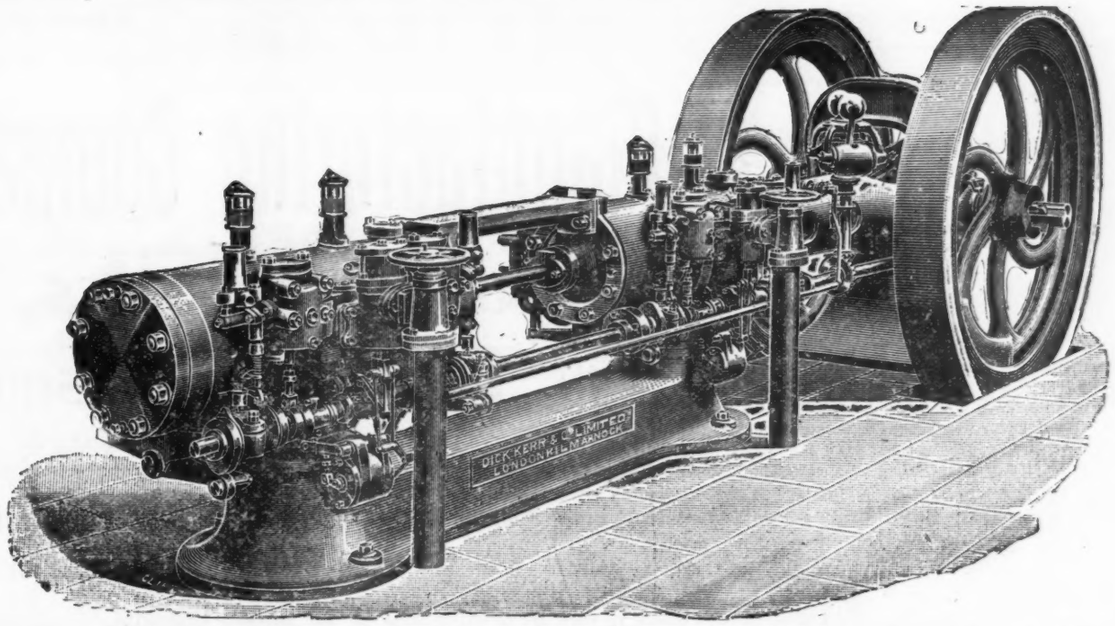

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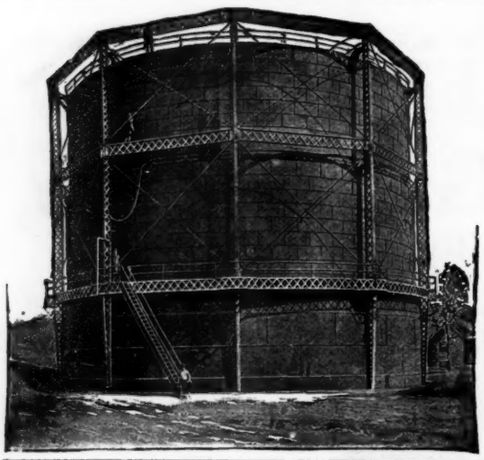

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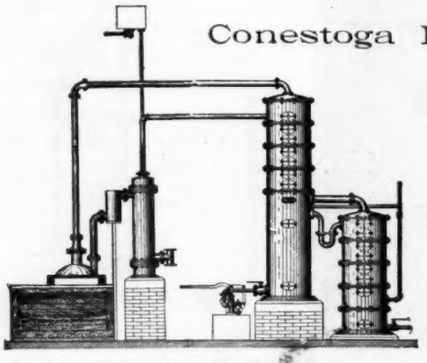

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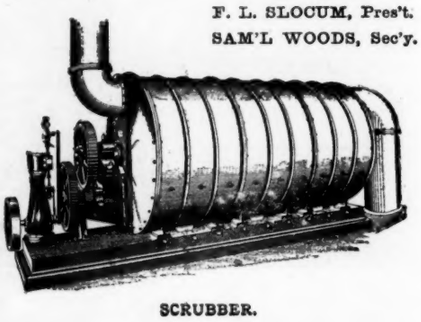

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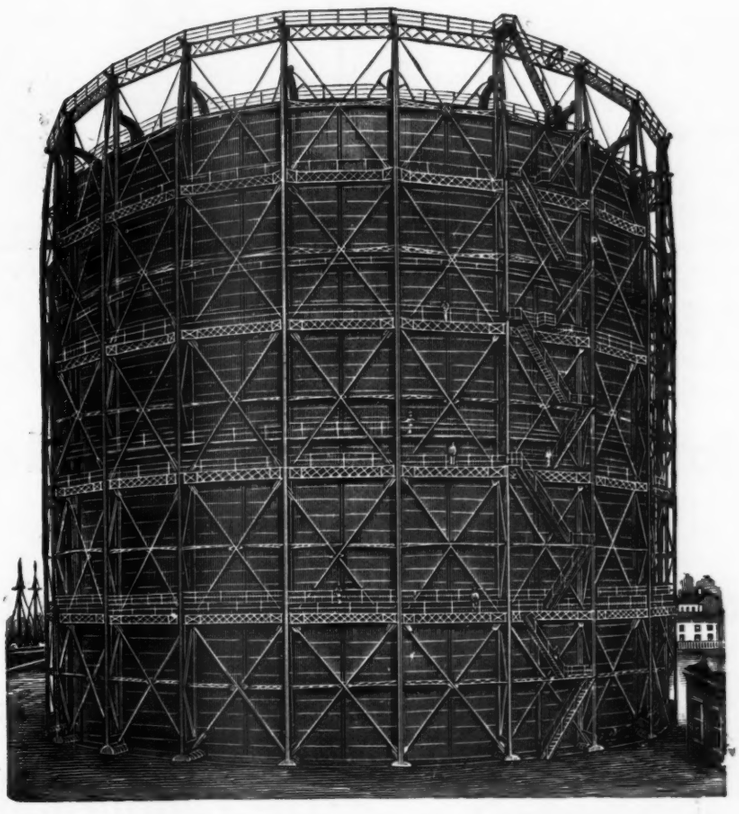

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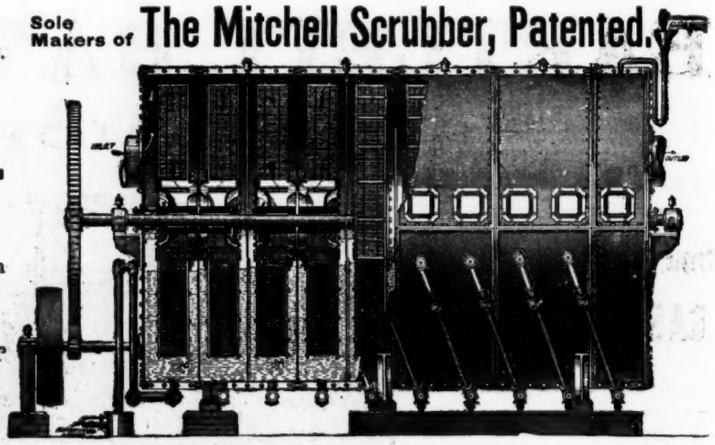

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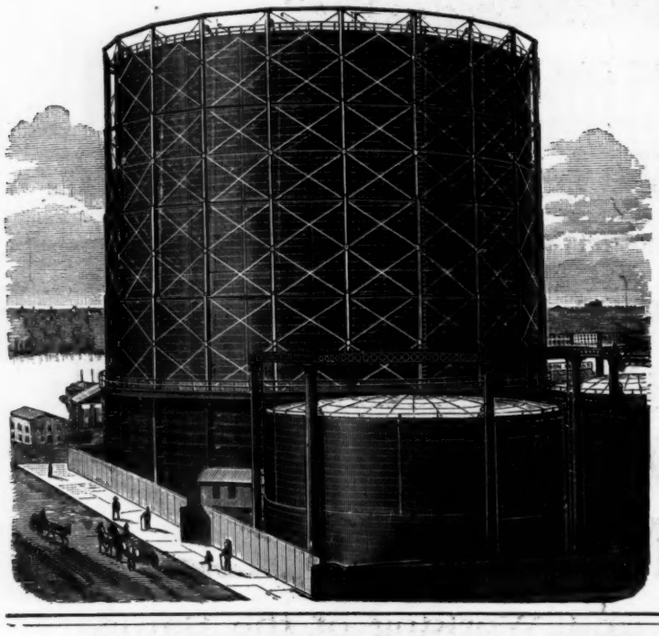

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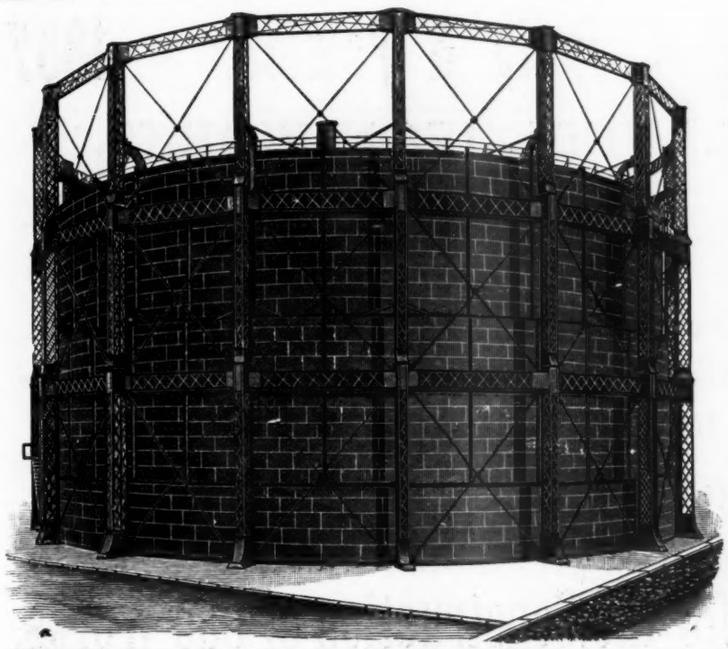

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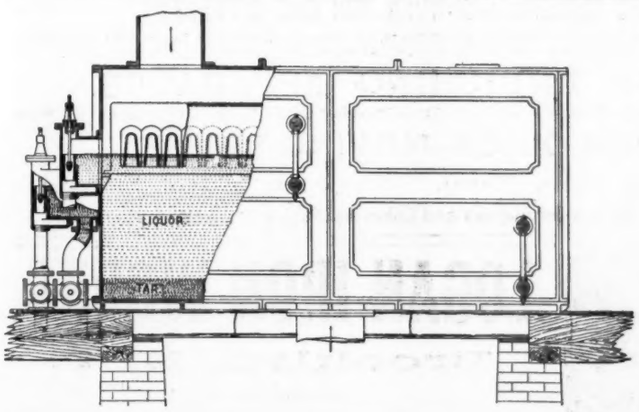

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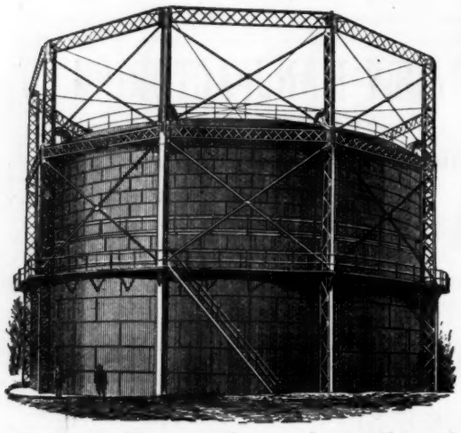

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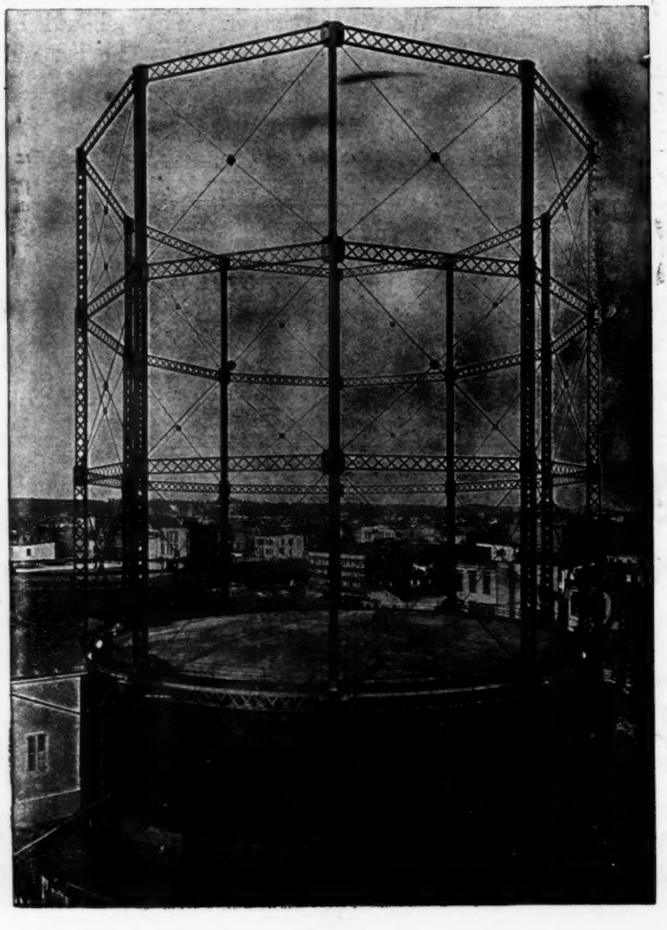

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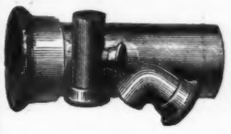

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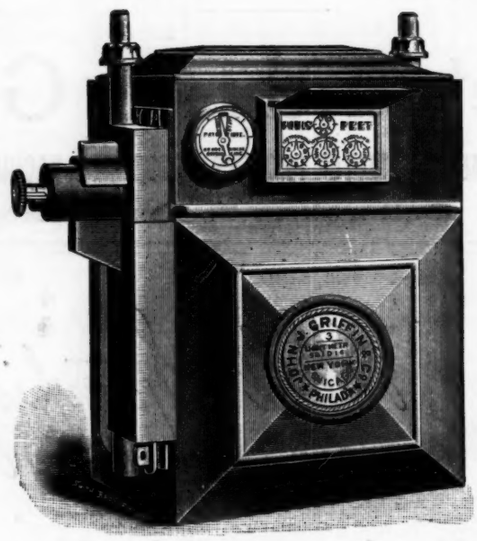

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